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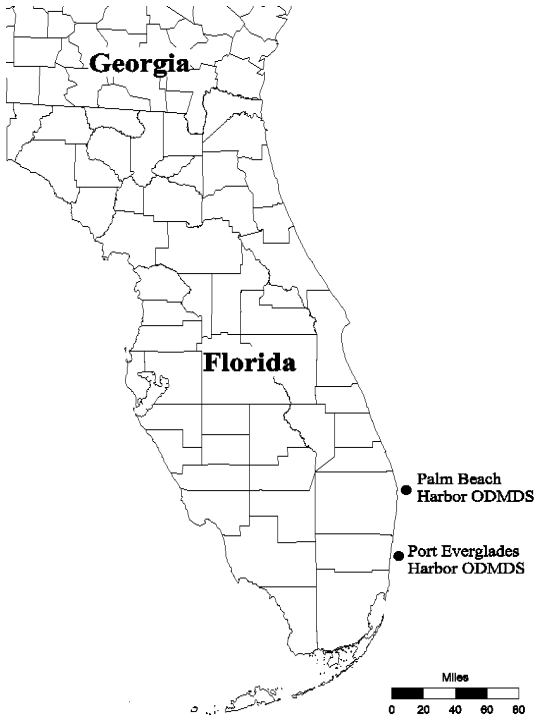
Sections 4.0 - 10

Final Environmental Impact Statement (FEIS) for Designation of the Palm Beach Harbor Ocean Dredged Material Disposal Site and the Port Everglades Harbor Ocean Dredged Material Disposal Site

July 2004



United States Environmental Protection Agency

U.S. EPA Region 4
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4.0 ENVIRONMENTAL EFFECTS

4.1 Introduction

This section of the EIS establishes the scientific and analytical basis for the summary of effects to environments in the affected area. The environmental consequences of the proposed action (i.e., designation of two ODMDSs, Palm Beach Harbor and Port Everglades Harbor) are discussed in the following sections. The socioeconomic consequences of the proposed action are exclusively beneficial and directly related to the socioeconomic benefits of functional ports in these areas, such as employment, commercial traffic and trade, commodity transport, and leisure cruising.

4.2 No-Action Alternative

Under the no-action alternative, a new ODMDS pursuant to Section 102 of the MPRSA would not be designated at either location. The no-action alternative would result in no additional or future impacts to the biological and physical components of the marine environment. However, ocean disposal of dredged material could occur on a limited basis under Section 103 of the MPRSA (see Section 2.1). The impacts to the biological and physical components of the marine environment associated with a Section 103 site selection and its limited use would be evaluated by the USACE at the time of selection.

4.3 Ocean Disposal Alternatives

4.3.1 Ocean Alternative Sites Not Considered

Although designation of ocean disposal site within 3 nmi of shore was considered, the possibility of unpredictable eddy currents from the Florida Current transporting disposed dredged material to nearshore reefs necessitated the designation of sites located further from the shore. Therefore, the interim sites at both Palm Beach Harbor and Port Everglades Harbor were not considered. In addition, the 3-mile candidate site was dropped from further consideration in favor of the 4.5-mile site as it was determined that a four square mile site was not necessary.

4.3.2 Evaluation Using General and Specific Criteria

The effects of the proposed action were evaluated using the criteria promulgated in 40 CFR Parts 228.5 and 228.6, which gives guidance for the selection of ocean disposal locations and require effective management to prevent unreasonable degradation of the marine environment. Criteria in 40 CFR Part 228.5 are titled “General criteria for the selection of sites,” and those in Part 228.6 are titled “Specific criteria for site selection.” Evaluation of the proposed Palm Beach Harbor and Port Everglades Harbor ODMDSs utilized the literature base and baseline data collected at the sites to assess compliance with both the general and the specific criteria of the regulation. Each of the general and specific criteria is addressed in this section as it relates to the suitability of the selected candidate sites as disposal sites. As presented in Section 2.5, the preferred site near Palm Beach Harbor has an area of approximately one square nmi and is located east-northeast of the Lake Worth Inlet approximately 4.5 nmi offshore. The Palm Beach Harbor 9-mile candidate site has an area of approximately four square nmi and is located approximately 9 nmi offshore east-northeast of the Lake Worth Inlet. The preferred site near Port Everglades Harbor has an area of approximately one square nmi and is located east-northeast of Port Everglades and approximately 4 nmi offshore.

The Port Everglades Harbor 7-mile candidate site has an area of approximately 4 square nmi and is located east-northeast of Port Everglades approximately 7 nmi offshore.

4.3.3 General Criteria (40 CFR 228.5)

1. The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries and regions of heavy commercial or recreational navigation [40 CFR 228.5(a)].

The proposed ODMDSs for the Palm Beach Harbor and the Port Everglades Harbor do not support an exclusive commercial or recreational fishery. Fishery and shellfishery resources are not concentrated in, restricted to, or dependent upon the vicinity of the proposed ODMDSs.

The proposed ODMDSs would not be expected to adversely affect recreational boating. Dredging and dredged material disposal are common actions in these areas. The proposed ODMDSs are at a sufficient distance offshore that small recreational boats are not frequently present.

There are also no specially designated shipping lanes near the proposed disposal sites. The candidate ODMDSs are located seaward and slightly north of the entrance channels of Palm Beach Harbor and Port Everglades Harbor, and are areas of heavy commercial shipping traffic. However, it is not anticipated that future, intermittent use of the site would result in a level of activity that would significantly disrupt shipping.

2. Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery [40 CFR 228.5(b)].

Based on dispersion modeling conducted for ODMDS designation for Palm Beach and Port Everglades harbors, any temporary perturbations in water quality resulting from disposal of dredged material would be reduced to ambient or undetectable levels within a short distance of the release point (Section 4.3.5). Prevailing currents at these sites are to the north and parallel the coast. The preferred ODMDSs lie 4.0 nmi (7.4 km) to 4.5 nmi (8.3 km) east of the nearest landfall. The candidate ODMDSs lie 9 nmi (16.7 km) and 7 nmi (13.7 km) east of the nearest landfall in Palm Beach and Broward counties, respectively The Palm Beach Harbor preferred ODMDS lies 1.7 nmi (3.2 km) east of the nearest reef (*Oculina varicosa*); the Palm Beach Harbor candidate ODMDS lies 6.2 nmi (11.5 km) east of this reef. At these locations, the likelihood of impacts to nearshore amenities is small. The proposed disposal sites do not lie near geographically limited fishery or shellfishery resources.

3. If at anytime during or after disposal site evaluation studies, it is determined that existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in CFR 228.5 through 228.6, the use of such sites will be terminated as soon as alternate disposal sites can be designated [40 CFR 228.5(c)].

The MPRSA site selection process is designed to identify a preferred alternative that minimizes or avoids unacceptable impacts to the physical, biological, and socioeconomic environment. The use of the previously designated interim disposal sites was discontinued as a result of the implementation of the Water Resources Development Act of 1992.

4. The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long-term impacts. The size, configuration, and location of any disposal site will be determined as part of the disposal site evaluation or designation study [40 CFR 228.5 (d)].

A limited area of about one square nmi (3.4 km^2) has been proposed for the preferred ODMDSs at Palm Beach Harbor and Port Everglades Harbor. Larger areas (4 square nmi) are required for the offshore candidate sites at both locations. The dispersion modeling studies for the preferred sites conducted by WES revealed no short-term or long-term adverse impacts (see Appendices K and M). The results indicated that the sediment was generally moving toward the north, not toward the reef. Under the most severe conditions, silt-clay concentrations diminish to approximately one mg/l or less above background at a distance of 1,500 m from the disposal location. For the preferred Port Everglades Harbor and Palm Beach Harbor ODMDSs, the dredged material would be disposed 6,100 m and 5,500 m from reef locations respectively. Due to the greater depths at the offshore candidate sites at both locations, larger disposal sites are required to contain most of the disposed dredged material within the site boundaries. Additionally even during the most severe storms and with mounds 10 times larger than the annual amount that each disposal site is expected to accommodate, the modeling of the mounds at both sites did not show significant erosion.

The location, size, and configuration of preferred sites allow and facilitate long-term capacity, site management, and site monitoring. Bottom contours in the area can be monitored through bathymetric survey methods. Monitoring of the proposed sites is discussed in the SMMPs (Appendix L).

5. EPA will, whenever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been historically [40 CFR 228.5 (e)].

The preferred Palm Beach Harbor and Port Everglades Harbor ODMDSs are located 4.5 nmi and 4 nmi from the coastline, respectively. The continental shelf in the vicinity of the proposed sites has a width of approximately 0.73 miles (0.63 nmi). The sites therefore lay approximately 3.87 nmi (Palm Beach Harbor) and 3.37 nmi (Port Everglades Harbor) beyond the edge of the continental shelf, and are located on the upper Florida-Hatteras slope. The offshore candidate sites also lay beyond the edge of the continental shelf. Historically used sites are also located on the upper continental slope, but their proximity to environmental amenities makes their use questionable.

4.3.4 Specific Criteria (40 CFR 228.6)

1. Geographical position, depth of water, bottom topography, and distance from coast [40 CFR 228.6(a)1].

See Table 18. Bottom topography images are provided in figures 1 and 3.

2. Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases [40 CFR 228.6(a)2].

The most active breeding and nursery areas are located in inshore waters, along adjacent beaches, or in nearshore reef areas. While breeding, spawning, and feeding activities may take place near the considered alternative ODMDSs, these activities are not believed to be confined to, or concentrated in, these areas. It is unlikely that localized and intermittent dredged material disposal operations would affect migration, feeding, or nesting of marine mammals and sea turtles. While many marine species may pass through the considered alternative ODMDSs, passage is not geographically restricted to these areas. The probability of significant impact from dredged material disposal is likely inversely related to the motility of these organisms.

3. Location in relation to beaches and other amenity areas [40 CFR 228.6(a)3].

The preferred disposal sites for Palm Beach and Port Everglades harbors are located approximately 4.5 nmi and 4.0 nmi offshore, respectively, as measured to the center of the sites. The offshore candidate disposal sites for Palm Beach and Port Everglades harbors are located approximately 9.0 nmi and 7.0 nmi offshore, respectively. The nearest beaches are located on the shorelines west of the sites. Distances from the western edge of the sites are provided in Table 18. Because of the distance of the proposed sites from the shoreline and the expected localized effects at the disposal sites, it is unlikely that dredged material disposal at any of the considered alternative sites would adversely affect coastal beaches. The locations in relation to amenity areas such as natural and artificial reefs were discussed in sections 3.4 and 3.13.1 and in tables 16 and 17. The locations relative to the considered alternative sites are summarized below:

Site	Distance to Nearest Artificial Reef	Distance to Outer Reef
Palm Beach 4.5-mile (preferred) site	2.3 nmi 4.3 km	2.6 nmi 4.8 km
Palm Beach 9-mile candidate site	5.8 nmi 10.7 km	7.2 nmi 13.3 km
Port Everglades 4-mile (preferred) site	2.3 nmi 4.3 km	3.0 nmi 5.5 km
Port Everglades 7-mile candidate site	5.0 nmi 9.3 km	6.2 nmi 11.5 km

Table 18. Geographic Position, Water Depth, Bottom Topography and Distance from Coast of ODMDSs

Site	Geographic Coordinates	Max/Min Depth	Bottom Topography	Min Distance to Shore (western edge)
Palm Beach 4.5-mile (preferred) site	26°47'30"N 79°57'09"W 26°47'30"N 79°56'02"W 26°46'30"N 79°57'09"W 26°46'30"N 79°56'02"W	509 ft/ 607 ft	Uniform Soft Bottom	4.3 nmi
Palm Beach 9-mile candidate site	26°45'00"N 79°53'00"W 26°45'00"N 79°51'00"W 26°47'00"N 79°53'00"W 26°47'00"N 79°51'00"W	855 ft/ 985 ft	Uniform Soft Bottom	8 nmi
Port Everglades 4-mile (preferred) site	26°07'30"N 80°02'00"W 26°07'30"N 80°01'00"W 26°06'30"N 80°02'00"W 26°06'30"N 80°01'00"W	577 ft/ 712 ft	Soft Bottom; E-W Oriented Low Relief Ridges in Center & NE Corner of Site	3.8 nmi
Port Everglades 7-mile candidate site	26°06'30" N 79°57'30"W 26°06'30" N 79°59'30"W 26°08'30" N 79°59'30"W 26°08'30" N 79°57'30"W	785 ft/ 920 ft	Soft Bottom in N giving way to Hard Bottom in S	6 nmi

Source: EPA 1999, 2000.

In addition to these artificial reef sites, colonies of the deepwater coral *Oculina varicosa* have been observed as scattered, isolated forms 1.7 nmi (3.2 km) west of the proposed Palm Beach Harbor ODMDS (see Figure 6).

WES (1998) conducted modeling studies under a variety of current velocities and directions to estimate the dynamics of the sediment cloud following its release from the disposal vessel. In all Port Everglades applications, results indicate silt-clay concentrations diminish to approximately 1 mg/l or less above background at a distance of 1,500 m west of the disposal location. Sand concentrations diminish to 1 mg/l or less above background at a distance of 2,440 m west of the disposal location. In all Palm Beach Harbor applications, silt-clay concentrations diminish rapidly to 1 mg/l or less above background within 1,500 m of the disposal location. Sand concentrations diminish to 1 mg/l or less above background within 2,400 m of the disposal location.

4. Types and quantities of wastes proposed to be disposed of and proposed methods of release, including methods of packing the dredged materials, if any [40 CFR 228.6(a)4].

The only material to be placed at the proposed ODMDSs will be dredged material that meets EPA Ocean Dumping Criteria in 40 CFR 220-229. The proposed sites are expected to be used for routine maintenance of the respective Harbor Projects. It has been demonstrated that the most cost effective method of dredging is clamshell/barge dredging for Palm Beach

Harbor (Appendix C) and hopper dredging for Port Everglades Harbor (Appendix D). The disposal of dredge material to the proposed sites will be conducted using a near instantaneous dumping type barge or scow.

Dredged material must meet EPA Ocean Dumping Criteria in 40 CFR 220-229 and will be tested following procedures outlined in the 1991 EPA/USACE Dredged Material Testing Manual (Green Book) and the 1993 EPA Region 4/USACE South Atlantic Division Regional Implementation Manual (RIM) prior to ocean disposal. Dredged material from the Palm Beach and Port Evergades harbors have been characterized in the following reports: Final Report for Port Everglades and Palm Beach Harbor Florida, 1998 Evaluation of Dredged Material for Ocean Disposal (PPB Inc.); Geotechnical Testing Services of Intracoastal Waterway for Channel Widening Project, Port Everglades (Ardaman and Assoc., 1997); and Soil Borings and Grab Sample Study on Atlantic Intracoastal Waterway, Port Everglades (Geoverse Inc., 1998).

Material from Palm Beach Harbor is predominantly sand with small amounts of silts. Samples collected from the harbor in 1997 contained 6% silts by weight, with the remainder consisting of sand.

Material from Port Everglades Harbor is more variable than that of Palm Beach Harbor. Samples collected from the harbor in 1997 contained 38% fines by weight for samples collected from the bay, and 5% fines by weight from samples collected from the inlet (the remainder in each case consisted of sand).

Palm Beach Harbor. Dredged material volumes for Palm Beach Harbor will vary from dredging event to dredging event depending on the amount of shoaling. Shoaling rates for the turning basin are projected to average 10,300 cy per year (see Appendix C). Total disposal volumes (turning basin and entrance channel) for the years in which the turning basin is dredged and hence ocean disposal is needed are expected to average in the range of 75,000-100,000 cy with volumes as large as 200,000 cy (Murphy, 2004). Disposal volumes of 75,000-100,000 cy every three years equates to annual averages of 25,000-35,000 cubic yards. Up to 1,000,000 cy of suitable material may be placed at the ODMDS in 2007 as a result of proposed construction dredging. Additional volumes that may be placed at the Palm Beach Harbor ODMDS include 9,000 cy from the North Turning Basin Extension (cited in the August 1984 Feasibility Report). Should ocean disposal be deemed appropriate for this material, and should the capacity of the designated sites be deemed adequate, then this material may be placed at the sites.

Port Everglades Harbor. Annual shoaling rates at Port Everglades Harbor have been estimated at 16,500 cy per year for the turning basin (Appendix D) and 15,600 cy for the entrance channel (Olsen & Assoc., 2003) for a total of approximately 30,000 cy per year. Dredging frequency has ranged from 6 to 20 years with project volumes in the range of 26,000-144,000 cy (Brodehl, 2003). The infrequent dredging has been due to the lack of available disposal options and with an available ocean disposal site, the frequency is expected to increase to every 3-5 years (Brodehl, 2004). Some or all of the maintenance material may be placed on the beach or utilized for other beneficial use when possible. Additional volumes that may be placed at the Port Everglades Harbor ODMDS include 8,079,400 cy between 2006 and 2024 from proposed construction activities at Port Everglades Harbor (see Section 1.2.4). Should ocean disposal be deemed appropriate for this material, and should the capacity of the designated sites be deemed adequate, then this material may be placed at the site.

5. Feasibility of surveillance and monitoring [40 CFR 228.6(a)5].

Monitoring of the preferred sites is discussed in the Site Management and Monitoring Plans (SMMPs) provided in Appendix L. Surveillance and monitoring of the preferred and candidate sites are feasible. However, due to the greater depths and greater distance offshore of the offshore candidate sites, monitoring would be more expensive for these sites. The depths at the offshore candidate sites are beyond EPA's current in-house sidescan sonar capability. Additionally, collecting grab samples from the bottom and water samples at these depths and high currents is more difficult than at the preferred sites.

6. Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any [40 CFR 228.6(a)6].

Previous Dredged Material Fate Studies in Close Proximity of the Project Alternative Sites. In response to a request by the Jacksonville District, WES performed technical studies of the Gulf Stream meanders, frontal eddies, and prevailing tides and currents off the east coast of Florida with respect to the potential for reef siltation by disposed dredged material originating from the Miami ODMDS. In these studies, both the short-term disposal and long-term erosion simulations of sediment transport as a function of local velocity fields indicated little possibility of affecting reefs as a direct result of use of the proposed sites (CERC, 1989; CERC, 1995).

In addition, the National Oceanic and Atmospheric Administration (NOAA) Atlantic Oceanographic and Meteorological Laboratory in Miami, Florida conducted a field study of the disposal plumes from the Miami Harbor project. The study concluded that the dredged material, except for a low concentration residual remaining within the water column, reached bottom within the designated site boundaries. For the discharges monitored, the resulting plumes were observed to be transported in a north to northeast direction (NOAA, 1991).

Dredged Material Fate Studies for Port Everglades/Palm Beach ODMDSs. An evaluation of the Port Everglades Harbor and Palm Beach Harbor ODMDSs was performed at the request of the USACE, Jacksonville District (see Appendix K). The study utilized three years of velocity data from an ADCP located offshore Port Everglades, Florida. The directional distribution of velocities reflected in the data indicates that the most prevalent currents are headed to the north and these currents also have the greatest average velocity. Maximum surface currents did not exceed 530 cm/sec with average surface currents on the order of 70 to 100 cm/sec. Currents are discussed further in Section 3.7. Additional work was requested by the USACE, Jacksonville District, to clarify, justify and further examine the study results (WES, 2001). The following discussion and results are taken from the original and supplementary studies conducted WES/CERC. Copies of the studies are also attached in appendices M and K.

Short-Term Modeling Results. STFATE was used to estimate the dynamics of the sediment cloud following its release from the dredge. The model computes the time-history of a single disposal operation from the time the dredged material is released from the barge until it reaches equilibrium. STFATE was used to model worst case and typical current profiles.

Port Everglades Harbor. In all Port Everglades Harbor applications sediment was disposed 6,100 m from the grid origin (reef location). Two sediment compositions were simulated, with 60% and 70% solids by weight and 38% and 5% fines, respectively. Additionally, eight velocity profiles were simulated ranging from 50% to 99% exceedence velocities in both the north and west direction. Results indicate silt-clay concentrations diminish to approximately 1 mg/l or less at a distance of 1,500 m west of the disposal location. Sand concentrations diminish to 1 mg/l or less at a distance of 2,440 m west of the disposal location. Under the most severe conditions (North 99 percentile velocity: 70% solids), the maximum total sediment concentration within 4,000 m from the reef location was approximately 3 mg/l at a depth of 137 m. A major portion of the dredged material is sand with a concentration of 2.7 mg/l, while the silt-clay concentration value was 0.5 mg/l.

The typical (median) velocity profile modeled was derived from analysis of the 0-5° from north angle band described in Cialone and Lillycrop (1998). A majority of the currents measured were in this angle band. Simulating sediment transport under these conditions describes the phenomena under typical conditions. The typical velocity profile indicated that the sediment was moving toward the northeast and not toward the reef. Concentrations for the typical velocity profile were never observed west of the disposal location, which was 6100 m from the reef. The results show that sediment is moving toward the north and approximately parallel to the shore away from the reef for the typical velocity profile. After 100 minutes, the maximum total concentration in the water column for the 70% solids case was 2 mg/l. Consequently, it can be concluded that under typical conditions no potential exists for sediment movement from the Port Everglades Harbor ODMDS onto the reef.

Palm Beach Harbor. In all Palm Beach Harbor applications sediment was disposed 5,500 m from the grid origin (reef location). Two sediment compositions were simulated, with 80% and 85% solids by weight and 6% fines. In addition, eight velocity profiles were simulated ranging from 50% to 99% exceedence velocities in both the north and west direction. Silt-clay concentrations diminish rapidly to 1 mg/l or less within 1,500 m west of the disposal location. Sand concentrations diminish to 1 mg/l or less within 2,400 m west of the disposal location. Under the most severe conditions (North 99 percentile velocity: 85% solids), the maximum total sediment concentration within 3,800 m from reef location was approximately 19 mg/l at a depth of 55 m. A major portion of the dredged material is sand with a concentration of 17.4 mg/l, while the silt-clay concentration value was 1.5 mg/l. The sand in the dredged material settles rapidly and it is expected that the concentration will decrease with closer distance to the reef.

The typical (median) velocity profile modeled was derived from analysis of the 0-5° from north angle band described in Cialone and Lillycrop (1998). A majority of the currents measured were in this angle band. Simulating sediment transport under these conditions describes the phenomena under typical conditions. The typical velocity profile indicated that the sediment was moving toward the north and approximately parallel to the shore away from the reef. After 105 minutes, the maximum total concentration in the water column for the 85% solids case was 2 mg/l.

It can therefore be concluded that under typical conditions no potential exists for sediment movement from the ODMDS at Palm Beach Harbor onto the reef.

Long Term Modeling Results. A screening level erosion model was used to estimate the long-term response of the dredged material mounds at the Port Everglades Harbor and Palm Beach Harbor ODMDSs to local environmental forcing functions. The screening level erosion modeling was completed using the three largest historical storms selected from the National Hurricane Center's HURDAT database. An additional case of a severe extratropical storm was also simulated for the Port Everglades Harbor site. The model was used to estimate the peak sediment flux and total sediment loss caused by the three severe tropical storms. A 305 m × 305 m × 0.41 m square mound configuration was assumed for a 50,000 cy mound. This volume represents the annual amount that each disposal site is expected to accommodate. The total sediment losses for each storm, in which the peak flux was assumed to occur for four hours across one side of the 305 m × 305 m disposal site, are 3.5 m^3 at the Port Everglades Harbor site (0.09% of 50,000 cy mound) and 3 m^3 at the Palm Beach Harbor site (0.08% of 50,000 cy mound).

The USACE also suggested applying the screening level erosion model for a larger mound of 500,000 cy (10 times the volume) to simulate the long-term fate of the disposal mound for both sites. The assumed dimension of the proposed mound was 965 m × 965 m × 0.41 m. The input data to the screening level model (wave height, wave period, water depth, sediment size, and velocity) were those used in the previous application. The total sediment loss for each storm was estimated when the peak flux was assumed to occur for four hours across one side of the 965 m × 965 m disposal site. The maximum computed total sediment loss is 11 m^3 at the Port Everglades Harbor site and 10 m^3 at the Palm Beach Harbor site; both are less than 0.003% of the disposed mound volume of 500,000 cy. The results of the study indicate that even during the most severe storms and with mounds 10 times larger than the annual amount that each disposal site is expected to accommodate, the mounds at the Port Everglades Harbor and Palm Beach Harbor sites will not be significantly eroded.

7. Existence and effects of current and previous discharges and dumping in the area (including cumulative effects) [40 CFR 228.6(a)7].

There are two formerly designated interim-designated ODMDSs near Palm Beach Harbor. Use of these sites was discontinued by the implementation of the Water Resources Development Act of 1992. The disposal of dredged material from Palm Beach Harbor was conducted annually between 1950-1953, 1955-59, 1961-63, 1968, 1979-81, and 1983. During this time, 5,230,828 cy (3,999,491 m^3) of material have been disposed. The characteristics of the dredged material are poorly graded sand with traces of shell fragments (Barry Vittor and Associates, Inc., 1985).

The existing EPA interim-designated ODMDS at Port Everglades Harbor is located approximately 2.5 nmi (4.6 km) west-southwest of the preferred site. It was first used for dredged material disposal in 1952. Required maintenance dredging of Port Everglades Harbor has been relatively infrequent and occurred in 1952, 1960, 1978, and twice in 1982. During this time, 219,810 cy (168,067 m^3) of material were disposed at the interim site. The characteristics of the dredged material are organic silt with some clay (Barry Vittor and Associates, Inc., 1985). No records of ocean disposal prior to 1952 are available for this area. A 1984 survey conducted by EPA indicated that some damage to nearby inshore, hard bottom areas may have occurred because of the movement of fine material associated with

the disposal of dredged material at the site. In light of the survey findings, disposal at the Port Everglades Harbor interim site was discontinued.

8. Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean [40 CFR 228.6(a)8].

Commercial Shipping/Recreational Boating. The preferred Palm Beach Harbor ODMDS is located just north and approximately 4.5 nmi (8.3 km) east of the entrance channel to the Port of Palm Beach and the Lake Worth inlet, an area of heavy commercial shipping traffic. Most traffic passes to the south of the alternative disposal sites. Therefore, the infrequent use of any of the alternative sites would not significantly disrupt either commercial shipping or recreational boating.

The preferred Port Everglades Harbor ODMDS is located just north and approximately 4.0 nmi (7.4 km) east of the entrance channel to the Port Everglades Harbor, an area of heavy commercial shipping traffic. Most traffic passes to the south of the alternative disposal sites. Therefore, the infrequent use of any of the alternative sites would not significantly disrupt either commercial shipping or recreational boating.

Fishing. Commercial and recreational fishing activity is concentrated in inshore and nearshore waters or at offshore natural and artificial reefs. Proximity of the considered alternative sites to the offshore natural and artificial reefs was discussed under Specific Criteria #3. All considered alternative sites are located at least 2.3 nmi (4.3 km) from the natural or artificial reefs. All considered alternative sites are located within reported habitat (175-300 m water depth) for the Golden Tilefish (Parker and Mays, 1998). EPA does not believe the Palm Beach Harbor preferred ODMDS provides the necessary malleable substrate from which the tilefish can construct shelter and that any impact to tilefish habitat at the Port Everglades Harbor preferred ODMDS will be minor (see Appendix I). Therefore, disposal activities are not expected to interfere with fishing activities.

Recreation. Coastal waters of Broward and Palm Beach counties are used for swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving, but few of these activities occur in, and none is restricted to, the preferred ODMDSs.

Mineral Extraction. No mineral extraction occurs in the immediate project area. According to the MMS, no data are available regarding sand resources in the project areas. The MMS has not identified any sources of beach quality material in the vicinity of the proposed sites.

Other Activities. No desalination or mariculture activities occur in the immediate area. Data for communication cables is not determinable within the project areas according to the Office of Public Affairs (OPA). FDEP further stated that undisclosed cables might potentially exist from the Navy. Placement of a natural gas pipeline is proposed between Port Everglades and Freeport, Grand Bahama Island. EPA is coordinating with other federal agencies in order to minimize any potential interferences with the proposed pipeline.

Scientific Resources. Located on the south side of the Port Everglades inlet in Dania, Florida, the South Florida Ocean Measurement Center (SFOMC, formerly the South Florida Testing Facility) has housed an active, continuously operating Navy range for over forty

years. The SFOMC was placed under the administration of the Naval Surface Warfare Center, Carderock Division in 1994. The SFOMC allows the monitoring of surface ship, submarine, and remote vehicle signatures in the nearshore environment. Multiple fixed in-water electromagnetic and acoustic measurement sites at 10, 20, and 200 m are controlled from a secure range house. The range encompasses the Navy's only shallow and deep magnetic research and development ranges, including submerged operations. The Port Everglades Harbor 4-mile (preferred) ODMDS is located approximately 1.5 miles from the northern boundary of the SFOMC.

9. The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys [40 CFR 228.6(a)9].

Baseline surveys conducted for the Palm Beach Harbor and the Port Everglades Harbor ODMDSs show the water quality and other environmental characteristics of the preferred and candidate ODMDSs to be typical of the Atlantic Ocean (Appendix H). Salinity, dissolved oxygen, and transmissivity data indicated water masses over the sites were similar to open ocean waters and deviated little between sites. Macroinfaunal samples were dominated in numbers by annelids and arthropods. All areas surveyed were similar in that they had a similar number of taxa dominated by the same major taxonomic groups. The southern portion of the Port Everglades Harbor 7-mile candidate site was dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.

10. Potential for the development or recruitment of nuisance species in the disposal site [40 CFR 228.6(a)10].

The disposal of dredged material should not attract or promote the development of nuisance species. No pre-disposal nuisance organisms were identified in surveys conducted in the vicinities of the proposed ODMDSs or in previously utilized disposal sites in the surrounding area.

Based on information on the community structure of the preferred sites, no adverse changes in benthic species composition are expected. The communities currently present in the sites are characteristic of sand bottom substrates. The material proposed for the disposal includes fine-grained sand. The similarity of dredged materials to the sediments of the disposal sites and surrounding areas should make the development or recruitment of undesirable species unlikely.

11. Existence at or in close proximity to the site of any significant natural or cultural features of historical importance [40 CFR 228.6(a)11].

No natural or cultural features of historical importance are known to occur at, or in proximity to, the preferred or candidate sites with the exception of the low relief limestone hard bottom identified in the southern portion of the Port Everglades Harbor 7-mile candidate site. No other significant features were noted in video or sidescan surveys of the alternative sites.

4.3.5 Summary of Specific Criteria Applications

Tables 19 and 20 summarize the application of the specific criteria to the sites.

4.3.6 Unavoidable Adverse Environmental Effects and Mitigation Measures

Unavoidable adverse impacts from dredged material disposal at any of the alternative sites include the following:

- Formation of temporary, localized water column changes associated with suspended sediment plumes;
- Burial and smothering of non-motile infauna and/or epifauna;
- Possible alterations in sediment texture, grain size and/or chemical composition; and
- Changes in bathymetry (mounding of material).

Plumes of suspended sediment associated with sinking dredged materials would result in increases in turbidity levels, suspended particulate concentrations, and decreased light transmittance. These effects are limited to disposal operations, are localized, short-term effects dissipated by natural dispersion, mixing, and eventual sinking of particles as discussed in Section 4.3.4. Use of the sites is expected to be infrequent.

Deposition of dredged materials will bury and smother localized populations of benthic organisms, reducing abundance and diversity of the benthic communities in the immediate area of dumping. The magnitude of this impact will depend on the extent of the affected area, volume of dredged material disposed, and specific tolerances of affected species to periodic burial. The recovery of impacted areas will reflect the ability of buried organisms to burrow through the sediment layer and the ability of adjacent populations to recolonize the area. Differences in grain size characteristics between the dredged materials and the existing site sediments could exacerbate impacts to the benthic fauna. Alterations in the bottom sediment texture could affect the survival of existing species or recruitment of new species. Benthic assemblages requiring hard substrate or structure will be less tolerant of burial and less able to recolonize than those assemblages associated with sand or sand-silt substrates.

With regard to water column effects and benthic impacts, mitigating measures include required periodic evaluations of dredged materials proposed for ocean disposal using applicable guidance. The periodic bioassay and bioaccumulation testing of dredged materials will ensure that dredged materials remain non-toxic to marine organisms. Mitigation includes selection of preferred disposal sites that avoid hard substrate or structure. In addition, disposal operations will be managed (see SMMPs in Appendix L) to limit the areal extent of burial. Site management and monitoring activities including routine bathymetry and site use documentation are mitigation measures for physical effects such as mounding, area covered, and frequency of impact for a specific area.

4.4 Socioeconomic Impacts

No significant socioeconomic impacts are anticipated because of actions associated with the proposed projects. Cost estimates for Port Everglades Harbor dredging (Appendix D) indicate that the 7-mile candidate site would increase project costs by 4-18% (depending on dredging method) over the 4-mile (preferred) site. For Palm Beach Harbor, cost estimates for dredging

Table 19. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Palm Beach Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (9-Mile Site)	Preferred Site (4.5-mile Site)
1.	Geographical position, depth of water, bottom topography and distance from coast.	See Figure 1. Approximately 9 nmi offshore Lake Worth Inlet on the upper continental slope. Depths: 855 to 985 feet (260 to 300 meters). Declivity of 65 ft (20 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.	See Figure 1. Approximately 4.5 nm offshore Lake Worth Inlet on the upper continental slope. Depths: 509 to 607 feet (155 to 185 meters). Declivity of at least 98 ft (30 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.
2.	Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (7.2 nmi) of the site. Passage through the site is not geographically restricted.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (4.8 nmi) of the site. Passage through the site is not geographically restricted.
3.	Location in relation to beaches and other amenity areas.	The site is located 8 nmi (14.8 km) from coastal beaches. The natural reef zones lay at least 7.2 nmi (13.3 km) inshore of the proposed sites. Artificial reef sites are located at least 5.8 nmi (10.7 km) west of the proposed sites. Isolated patches of *Oculina* lay approximately 7.4 nmi (13.7 km) west of the site.	The site is located 4.3 nmi (8.0 km) from coastal beaches. The natural reef zones lay at least 2.6 nmi (4.8 km) inshore of the proposed sites. Artificial reef sites are located at least 2.6 nmi (4.8 km) west of the proposed sites. Isolated patches of *Oculina* lay approximately 1.7 nmi (3.2 km) west of the site.
4.	Types and quantities of waste proposed to be disposed of, and proposed methods of release, including methods of packing the waste if any.	The only material to be disposed in the ODMDS will be dredged material that complies with EPA Ocean Dumping Regulations (40 CFR 220-229).	The only material to be disposed in the ODMDS will be dredged material that complies with EPA Ocean Dumping Regulations (40 CFR 220-229).
5.	Feasibility of surveillance and monitoring.	Feasible. However, depths, currents and distance from shore increase cost of monitoring.	Feasible. Draft Site Management and Monitoring Plan is included in this EIS as Appendix L.
6.	Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and

Table 19. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Palm Beach Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (9-Mile Site)	Preferred Site (4.5-mile Site)
		maximum velocities of 130 cm/sec have been measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach Harbor and Port Everglades Harbor ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.	maximum velocities of 130 cm/sec have been measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach Harbor and Port Everglades Harbor ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.
7.	Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).	No current or prior dumping or discharges in the area.	No current or prior dumping or discharges in the area.
8.	Interference with shipping, fishing, recreation, mineral extraction, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.	No significant interference is anticipated.	No significant interference is anticipated. Closest fishing areas are located ≥2.0 nmi (3.7 km) inshore of the site.
9.	The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.	Water quality at the sites is typical of the Atlantic Ocean. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.	Water quality at the sites is typical of the Atlantic Ocean. The location of the Florida Current determines whether the site waters are predominantly coastal or oceanic. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.
10.	Potential for the development of nuisance species in the disposal site.	Disposal should not recruit or promote the development of nuisance species.	Disposal should not recruit or promote the development of nuisance species.
11.	Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.	No known features.	No known features.

Table 20. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Port Everglades Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (7-Mile Site)	Preferred Site (4-Mile Site)
1.	Geographical position, depth of water, bottom topography and distance from coast.	See Figure 2. Approximately 7 nmi offshore Port Everglades, FL on the upper continental slope. Depths: 785 to 920 feet (240 to 280 meters). Declivity of at least 68 ft (20 m) per nautical mile (nmi) [1.85 kilometers (km)]. Northern half of site dominated by uniform sandy bottom. Low relief hard bottom in southern half of site.	See Figure 2. Approximately 4 nmi offshore Port Everglades, FL on the upper continental slope. Depths: 640 to 705 feet (195 to 215 meters) Declivity of at least 135 ft (40 m) per nautical mile (nmi) [1.85 kilometers (km)]. Uniform fine sandy bottom.
2.	Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (6.2 nmi) of the site. Passage through the site is not geographically restricted.	None concentrated in or restricted to the proposed disposal sites. Most breeding, spawning, nursery, and feeding activities take place in coastal waters or at reef areas located shoreward (3 nmi) of the site. Passage through the site is not geographically restricted.
3.	Location in relation to beaches and other amenity areas.	The site is located 6 nmi (11.1 km) from coastal beaches. The natural reef zones lay at least 6.2 nmi (11.4 km) inshore of the proposed sites. Artificial reef sites are located at least 5 nmi (9.3 km) west of the proposed sites.	The site is located 3.8 nmi (7.1 km) from coastal beaches. The natural reef zones lay at least 3 nmi (5.6 km) inshore of the proposed sites. Artificial reef sites are located at least 2.3 nmi (4.3 km) west of the proposed sites.
4.	Types and quantities of waste proposed to be disposed of, and proposed methods of release, including methods of packing the waste if any.	The only material to be disposed in the ODMDS will be dredged material that complies with EPA Ocean Dumping Regulations (40 CFR 220-229).	The only material to be disposed in the ODMDS will be dredged material that complies with EPA Ocean Dumping Regulations (40 CFR 220-229).
5.	Feasibility of surveillance and monitoring.	Feasible. However, depths, currents and distance from shore increase cost of disposal.	Feasible. Draft Site Management and Monitoring Plan is included in this EIS as Appendix L.
6.	Dispersal, horizontal transport, and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and maximum velocities of 130 cm/sec have been	Prevailing currents parallel the coast and are generally oriented along a north-south axis. Northerly flow predominates. According to the latest ADCP data from 1995 to 1997, mean surface currents range from 10 to 100 cm/sec depending on direction with maximum velocities up to 530 cm/sec. Current speeds are lower and current reversals more common in near-bottom waters. Mean velocities of 20 cm/sec and maximum velocities of 130 cm/sec have been

Table 20. Summary of the Specific Criteria as Applied to the Preferred and Candidate Ocean Dredged Material Disposal Sites for Port Everglades Harbor

Criteria as Listed in 40 CFR 228.6(a)		Offshore Candidate Site (7-Mile Site)	Preferred Site (4-Mile Site)
		measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach Harbor and Port Everglades Harbor ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.	measured for near-bottom waters in the area. Dredged material dispersion studies conducted by the USACE for both short and long-term fate of material disposed at Palm Beach Harbor and Port Everglades Harbor ODMDSs indicate little possibility of disposed material affecting near-shore reefs in the areas of the disposal sites.
7.	Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).	No current or prior dumping or discharges in the area.	No current or prior dumping or discharges in the area.
8.	Interference with shipping, fishing, recreation, mineral extraction, fish and shellfish culture, areas of special scientific importance, and other legitimate uses of the ocean.	No significant interference is anticipated.	No significant interference is anticipated. Closest fishing areas are located ≥2.0 nmi (3.7 km) inshore of the site.
9.	The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.	Water quality at the sites is typical of the Atlantic Ocean. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat. The southern portion of the site is dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.	Water quality at the sites is typical of the Atlantic Ocean. The location of the Florida Current determines whether the site waters are predominantly coastal or oceanic. The site supports a benthic and epibenthic fauna characteristic of upper continental slope habitat.
10.	Potential for the development of nuisance species in the disposal site.	Disposal should not recruit or promote the development of nuisance species.	Disposal should not recruit or promote the development of nuisance species.
11.	Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.	The southern portion of the site is dominated by low relief limestone hard bottom. This hard bottom area may be considered a unique ecological community.	No known features.

(Appendix C) indicate that the 9-mile candidate site would increase project costs by 6-18% (depending on dredging method) over the 4.5-mile (preferred) site.

4.5 Cumulative Impacts

Cumulative impacts are defined in 40 CFR 1508.7 as "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions." NEPA guidance requires that such connected, similar impacts be examined.

4.5.1 Past Projects

EPA Interim-Designated ODMDSs

Dredged material disposal has occurred at the EPA interim-designated ODMDSs discussed in Section 2.4. Use of the two interim sites for Palm Beach Harbor was discontinued as a result of the implementation of the WRDA of 1992. The interim site for Port Everglades Harbor was discontinued after a 1984 EPA survey indicated that some damage to nearby inshore, hard bottom areas may have occurred due to the movement of fine material associated with disposed dredged material.

4.5.2 Current Projects

Maintenance of Palm Beach and Port Everglades Harbors Federal Navigation Projects

These projects will continue to require periodic dredging to maintain adequate depths for access and safe navigation. Ocean dredged material disposal will likely be required for these projects. The need for ocean disposal is based primarily on the lack of economically, logistically, and environmentally feasible alternatives for the disposal of the projected quantities of dredged material deemed unsuitable for beach nourishment or other beneficial uses.

Intracoastal Waterway Federal Navigation Project

The Intracoastal Waterway (ICWW) provides deep draft access to coastal Florida in the vicinity of the study area. The ICWW is confined from the open ocean by the outer rim of barrier islands in Palm Beach and Broward counties and is located a substantial distance from the continental shelf-slope break. Ocean disposal of dredged material is unlikely to result from this project.

Beach Re-Nourishment Projects

Federal beach re-nourishment projects exist for both Palm Beach and Broward counties. Both projects allow for the restoration of beaches to a general width of 100 ft with a berm elevation of 10 ft above mean low water, and periodic nourishment thereafter. Dredged material from Palm Beach and Port Everglades harbors that is beach quality may be used for these projects. Beach re-nourishment projects are nearshore activities and would not likely result in impacts to offshore environments such as those in which the project areas are located.

Wastewater Outfalls

Current projects that may serve as potential sources of pollution in the area include wastewater outfalls. Offshore sewage outfalls have been used to discharge untreated or partially treated domestic wastewater in southeastern Florida for over 60 years. Under current regulations, untreated effluent is no longer discharged, and the discharged effluent has undergone secondary treatment and chlorination. Two wastewater ocean outfalls discharge into ocean waters near Palm Beach Harbor and two wastewater ocean outfalls discharge into ocean waters near Port Everglades Harbor. Amplifying information on these facilities is provided in tables 21 and 22.

Table 21. Wastewater Ocean Outfalls in the Vicinity of Palm Beach Harbor

Facility Description	Address (City)	Distance to 4.5-Mile (Preferred) Site (mi)
Delray Beach WTP	Unknown (Delray Beach)	26.8
Boca Raton WTP	1501 W Glades Rd (Boca Raton)	31.3

Source: EPA, 1998.

Table 22. Wastewater Ocean Outfalls in the Vicinity of Port Everglades Harbor

Facility Description	Address (City)	Distance to 4-Mile (Preferred) Site (mi)
Broward County North District WTP	2401 N Powerline Rd (Pompano Beach)	12.4
Hollywood WTP	3441 Hollywood Blvd (Hollywood)	11.1

Source: EPA, 1998.

Recent studies on the impact of wastewater outfalls on marine habitat indicate that nutrient loading would be the likely source of any impacts to the habitat (EPA, 1998). However, significant adverse impacts to marine environments have not been documented in association with offshore wastewater outfalls, owing to dilution and mixing under the influence of prevailing currents. Additionally, any impacts would be ongoing, and would likely have been incorporated into existing water quality parameters.

4.5.3 Reasonably Foreseeable Future Projects

Potential reasonably foreseeable future projects in the vicinity of the project areas may include subsea placement of fiber optic cables, USACE harbor maintenance dredging projects, new or proposed USACE harbor deepening projects, and USACE beach re-nourishment projects. Future projects in the vicinity of the project area could involve channel modifications that are currently unknown.

Subsea Cable Placement

No projects for future subsea placement of fiber optic cables are known to exist at this time for offshore Palm Beach or Broward counties. Charts obtained from AT&T provide the locations of existing telephone cables offshore of Palm Beach and Broward counties as of 30 August 1996. The charts indicate that two telephone cables may intersect the preferred and candidate sites for the Palm Beach Harbor ODMDS. The cables are listed as out of service on the chart. No existing cables that

may intersect that proposed sites for Port Everglades Harbor were noted on the chart. The FDEP Southeast Office was contacted regarding fiber optic cables offshore of Pam Beach and Broward counties. FDEP reported that fiber optic cable landings occur at West Palm Beach, Delray Beach, and Boca Raton in Palm Beach County; and Port Everglades and Hollywood in Broward County. FDEP further stated that undisclosed cables might potentially exist from the Navy. The fiber optic cables at West Palm Beach and Port Everglades may lie in close proximity to the proposed Palm Beach Harbor and Port Everglades Harbor sites, respectively; however, based on the available evidence, it is unlikely that these cables intersect the proposed sites. No known instances of damage to underwater cables occurring as a result of offshore dredged material disposal were found. Consequently, it is unlikely that any impacts to underwater cables in the vicinity of the project area will occur as a result of implementation of the proposed project.

AES Ocean Express Pipeline Project

AES Ocean Express LLC has submitted an application to lay a 54.3-mile, 24-inch pipeline from a receipt point on the Economic Exclusion Zone between the United States and the Bahamas to delivery points in Broward County, Florida, together with certain ancillary facilities. Approximately 48 miles of this pipeline will be laid in the Atlantic Ocean off Florida's east coast. The remaining 6.3 miles would extend west from a shoreline entry point east of Dania, Florida, and end at proposed interconnections with Florida Gas Transmission Company and Florida Power and Light Company systems. The proposed pipeline would transport up to 842 million standard cubic feet of natural gas into Florida per day. According to the project FEIS, construction of the AES Ocean Express Pipeline would impact approximately 2.9 acres (0.01 km^2) of hardbottom habitat. Disruption of offshore live bottom habitats is expected to be minimal because of the use of horizontal directional drilling during construction. Local temporary increases in turbidity would also likely result from project implementation. Any temporary impacts to offshore essential fish habitat and commercial fisheries resulting from project implementation would be temporary and expected to recover shortly after construction activities were completed.

Although specific geospatial coordinates of the AES Ocean Express Pipeline are not readily available, comparison of the pipeline project's map layout with that of the proposed Port Everglades Harbor ODMDS indicates that the proposed pipeline route appears to pass no closer than approximately 4 nmi south of the preferred (4-mile) site.

Tracetebel Calypso Pipeline Project

Tractebel Calypso LLC has also proposed construction of a pipeline to transport natural gas from the Bahamas to South Florida. This 24-inch pipeline would begin at a proposed regasification plant near Freeport, Bahamas and be laid 89.9 miles to Port Everglades in Broward County Florida, where it will connect with the proposed Tractebel Calypso onshore pipeline segment. Approximately 36 miles of this pipeline would extend from the Economic Exclusion Zone to the coast of Florida. The proposed pipeline is 90 miles in total length and will transport up to 832 million standard cubic feet of natural gas per day. Directional drilling will be utilized at the onshore approaches to the pipeline to minimize environmental effects. According to the project FEIS, construction of the Tractebel Calypso Pipeline would impact approximately 16.2 acres of marine habitat. Approximately 7.2 acres (0.03 km^2) of this habitat occurs at a depth of less than 200 ft (61 m). Of these 7.2 acres, approximately 4.7 acres (0.02 km^2) are natural or artificial hardbottoms. Avoidance of deepwater hardbottom and live bottom habitat has been incorporated into the proposed pipeline route. Local temporary increases in turbidity would also likely result from project implementation.

Disruption of offshore live bottom habitats is expected to be minimal because of the use of horizontal directional drilling in sensitive habitat areas during construction.

Although specific geospatial coordinates of the Tractebel Calypso Pipeline are not readily available, comparison of the pipeline project's map layout with that of the proposed Port Everglades Harbor ODMDS indicates that the proposed pipeline route is in close proximity to the preferred and candidate sites for the Port Everglades Harbor ODMDS. EPA expressed concern in a letter dated 17 September 2003 regarding a conflict between the proposed pipeline alignment and the proposed Port Everglades Harbor sites. The Federal Energy Commission, in its response to this letter, stated that the proposed Calypso pipeline alignment would avoid both the preferred and the candidate sites for the Port Everglades Harbor ODMDS.

El Paso Seafarer Pipeline Project

Florida Power and Light Group Resources and El Paso Corporation signed an agreement in April 2004 for capacity on the proposed El Paso Seafarer Pipeline System. The proposed pipeline will have a total length of 160-miles and a diameter of 26 inches. The system as planned will transport natural for the proposed High Rock liquefied natural gas regasification facility in the Bahamas to south Florida. Landfall will be at Riviera Beach in Palm Beach County, from which the pipeline will extend 42 miles to an existing gas pipeline and a power generation plant. A pipeline capacity of 800,000 dekatherms per day of natural gas is planned. Transportation service is estimated to begin in 2008, when the pipeline and the proposed Bahamas facility are scheduled to be completed. No project FEIS has been completed for the El Paso Seafarer Pipeline; consequently, impacts resulting from pipeline construction have not been quantified.

Although specific geospatial coordinates of the El Paso Seafarer Pipeline are not readily available, a comparison of the pipeline project's map layout with that of the proposed Palm Beach Harbor ODMDS indicates that the pipeline appears to pass no closer than 1-2 nmi south of the preferred (4.5-mile) site.

Palm Beach Harbor Construction

A feasibility study has been proposed for construction dredging at Palm Beach Harbor (currently proposed to take place in 2007). This feasibility study will augment a recently completed reconnaissance study which stated that deepening of the existing Federal project was justified. Construction activities at the harbor may result in the dredging of up to 1,000,000 cy of material. Additionally, construction of the harbor's North Turning Basin Extension (cited in the August 1984 Feasibility Report), may result in the dredging of 9,000 cy of material. Ocean dredged material disposal would likely be required for this project. Impacts resulting from the proposed construction dredging at Palm Beach Harbor include temporary increase in turbidity in the vicinity of dredging operations.

Port Everglades Harbor Deepening Project

A feasibility study is currently underway for improving the Federal navigation project at Port Everglades Harbor. The project, if approved, would consist of widening and deepening all the port's major channels and basins to accommodate future development. The proposed entrance channel would extend approximately 2,200 ft seaward from its current position. Three different stages of

deepening are currently proposed to occur between 2006 and 2012. An estimated volume of 7,379,400 cy of dredged material are expected to be generated by these deepening activities. Maintenance dredging of the project is currently proposed for 2024; an estimated 700,000 cy are expected to be removed during maintenance dredging. Ocean dredged material disposal would likely be required for this project. Impacts resulting from the proposed improvements at Port Everglades Harbor include temporary increase in turbidity in the vicinity of dredging operations.

4.5.4 Conclusion

Disposal of dredged material at the proposed ODMDS locations would result in temporary increases in turbidity in the vicinity of the proposed sites. Temporary increases in turbidity are also anticipated for several of the projects described above; however, it is unlikely that actions associated with the above projects would occur concurrently with disposal of dredged material at the proposed sites. Additionally, increases in turbidity from either dredged material disposal or actions associated with the above projects would be temporary in nature.

Impacts to offshore habitat from wastewater outfalls would most likely be caused by nutrient loading (EPA, 1998). Significant nutrient loading resulting from disposal of dredged material at the proposed ODMDS locations is not anticipated.

Both the AES Ocean Express and Tractebel Calypso Pipeline projects involve impacts to hardbottom habitats. At least 10.1 acres (0.04 km^2) of hardbottom habitat would be impacted by construction of these pipelines. No hardbottom natural reefs have been observed within the proposed ODMDS locations for either Palm Beach or Port Everglades harbors; however, the southern portion of the 7-mile site at Port Everglades Harbor, an area of approximately 420 acres (1.7 km^2) consists of relatively low relief hardbottom (see Appendix E). Consequently, as much as 430.1 acres (1.74 km^2) of ocean hardbottom habitat would be impacted by the combined effects of these actions if the 7-mile site were selected. No hardbottoms were detected at the preferred sites for either Palm Beach Harbor or Port Everglades Harbor; therefore designation of the ODMDSs at the preferred sites would not result in cumulative impacts to ocean hardbottoms in conjunction with other projects.

Significant adverse cumulative impacts are not anticipated from the designation of ODMDS locations for Palm Beach and Port Everglades harbors, in conjunction with past, present, or reasonably foreseeable future actions in the offshore waters off Palm Beach and Broward counties. Future projects in the area would be subject to the requirements of and would be evaluated in accordance with NEPA.

4.6 Relationship Between Local Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Use of the proposed ODMDSs in the manner described should have no effect on long-term productivity. Based on modeling for the Miami ODMDS, the disposal of dredged materials at the proposed ODMDSs would not result in significant long-term water quality degradation. Water quality impacts of concern with regard to dredged material disposal include those associated with increased turbidity, decreased DO levels, and the release of sediment-bound contaminants such as heavy metals, nutrients, and hydrocarbons, including pesticides and PCBs. Generally, contaminants bound in sediments are not released under conditions normally occurring at open water disposal sites (Burks and Engler, 1978; Saucier *et al*., 1978). Most potential contaminants remain sorbed on sediments, or are readily scavenged from the water column by particulate matter and metal oxides,

and precipitated. In addition, only material meeting ocean disposal criteria will be disposed at the site.

Increased turbidity resulting from dredged material disposal is generally short-term and transient (Windom, 1976). Elevated turbidity levels occur during dredged material disposal, but decrease rapidly as suspended sediments settle or disperse. Some increases in turbidity could occur at the pycnocline.

Temporary decreases in DO may occur during disposal. Given the depth of the well-mixed portion of the water column at the proposed ODMDS, significant offsite impacts are not expected and any onsite impacts should be of short duration.

Nutrients bound in sediments would be released to the water column during disposal. Soluble phosphorous would be temporarily released but would be rapidly scavenged from the water column (Burks and Engler, 1978). Soluble nitrogen compounds, particularly ammonia, would also be released during disposal.

The potential for water quality impacts resulting from the release of trace metals is minor. Most heavy metals are poorly soluble and are readily sorbed by suspended matter and precipitated (Windom, 1976; Burks and Engler, 1978). Hydrocarbons, such as pesticides and PCBs, are generally poorly water-soluble. These substances generally remain sorbed on sediments and are not released during disposal (Windom, 1976; Burks and Engler, 1978).

The disposal of uncontaminated sediments in compliance with EPA's Ocean Dumping Regulations and Criteria (40 CFR 220-229) would not be expected to result in sediment quality degradation. Periodic bioassay testing (toxicity/bioaccumulation) of proposed dredged material is required to ensure compliance.

Impacts of dredged material disposal on organisms in the water column are difficult to assess but are generally considered minimal and temporary (Pequegnat *et al.*, 1981). Most motile organisms (nekton) can avoid disposal operations and localized areas of poor water quality. Nonmotile (planktonic) organisms such as phytoplankton, zooplankton, and ichthyoplankton entrained within the disposal plume would be directly affected. The impacts of disposal on these organisms are difficult to assess in light of the high natural variability of planktonic communities. Significant long-term impacts are not anticipated.

Sedentary and slow-moving benthic and epibenthic biota could be impacted both directly and indirectly by dredged material disposal. Direct impacts would result from the smothering of bottom-dwelling organisms under varying depths of dredged material. These impacts would result in the loss of some of the disposal site biota and the resultant alteration of benthic community structure. The high reproductive potential of most benthic infaunal species is expected to re-establish pre-disposal conditions rapidly.

Direct impacts would occur at the specific sites of disposal. Recolonization from both the vertical migration of resident infaunal species and the recruitment of species from nearby areas would occur rapidly after completion of disposal operations.

Indirect impacts to biota could include the disruption of localized population dynamics of individual species. Indirect impacts would occur in and near the disposal sites.

4.7 Irreversible or Irretrievable Commitment of Resources

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. Non-renewable fossil energy (petroleum) used for fuel during project activities would be an irreversible loss.

With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Estimates for Port Everglades Harbor dredging indicate that the 7-mile candidate site would increase fuel consumption by 28% or 130 gallons per load over the 4-mile (preferred) site. This equates to approximately 9,100 gallons of fuel for a 50,000 cy project. For Palm Beach Harbor, estimates for dredging indicate that the 9-mile candidate site would increase fuel consumption by 40% or 192 gallons per load over the 4.5-mile (preferred) site. This equates to approximately 14,881 gallons of fuel for a 50,000 cy project (Fletcher, 2003).

An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. Other than creating a potential for altering the structure of benthic communities by possibly changing the characteristics of the substrate, no irretrievable loss of resources is expected.

4.8 Relationship of the Proposed Action to Other Federal Projects

Palm Beach Harbor is located in Palm Beach County along the ICWW at the Lake Worth Inlet. Palm Beach Harbor is located approximately 4.5 nmi from the harbor's preferred site for ODMDS designation. The Federal Project at Palm Beach Harbor would utilize the proposed ODMDS for dredged material disposal. Total disposal volumes (turning basin and entrance channel) for the years in which the turning basin is dredged and hence ocean disposal is needed are expected to average in the range of 75,000-100,000 cy with volumes as large as 200,000 cubic yards (Murphy, 2004). Up to 1,000,000 cy of suitable material may be placed at the ODMDS in 2007 as a result of proposed construction dredging. Additional volumes that may be placed at the Palm Beach Harbor ODMDS include 9,000 cy from the North Turning Basin Extension (cited in the August 1984 Feasibility Report).

Port Everglades Harbor is located in Port Everglades County along the ICWW immediately south of Forth Lauderdale. Port Everglades Harbor is located approximately 4 nmi from the harbor's preferred site for ODMDS designation. The Federal Project at Port Everglades Harbor would utilize the proposed ODMDS for dredged material disposal. Annual shoaling rates at Port Everglades Harbor have been estimated at 16,500 cy per year for the turning basin (Appendix D) and 15,600 cy for the entrance channel (Olsen & Assoc., 2003) for a total of approximately 30,000 cubic yards per year. Additional volumes that may be placed at the Port Everglades Harbor ODMDS include 8,079,400 cy between 2006 and 2024 from proposed construction activities at Port Everglades Harbor (see Section 1.2.4).

The ICWW provides deep draft access to coastal Florida in the vicinity of the study area. The ICWW intersects Palm Beach and Port Everglades harbors and is equidistant to the preferred ODMDS locations at these points relative to the harbors. The ICWW is confined from the open ocean by the outer rim of barrier islands in Palm Beach and Broward counties and is located a

substantial distance from the continental shelf-slope break. No material from the ICWW is expected to be disposed at either of the proposed ODMDS locations.

The proposed Port Everglades Harbor ODMDS is located approximately 1.5 miles north of the northern boundary of the Navy's SFTF. The SFTF is currently the centerpiece of the newly formed SFOMC. The SFOMC offers a means to evaluate mine detection, countermeasures, and mine response; perform acoustic measurements; and acquire radar cross section and infrared signatures. The SFOMC is the only ship, submarine, and mine-effectiveness test range with simultaneous air, surface, and subsurface tracking capability. Some of the SFOMC's underwater detection and monitoring apparatus on the northern portion of the range may be adversely impacted by activities associated with the implementation of the proposed Port Everglades Harbor site. Passive monitoring equipment would likely experience the largest impacts.

Mr. William Baxley, Environmental Liaison for the SFOMC, was contacted regarding impacts to the SFOMC resulting from disposal of dredged material at the proposed ODMDS locations. Mr. Baxley agreed to provide a brief text description of potential impacts to the facility. At the time of the current submittal, this information remains outstanding.

4.9 Essential Fish Habitat

The Fishery Management Amendments of the South Atlantic Fishery Management Council identify a number of categories of EFH and HAPC. Due to the offshore location of the proposed dredged material disposal sites, many of the areas listed as EFH and HAPC, were eliminated from consideration for this project. Estuarine areas such as estuarine emergent wetlands, intertidal flats, and estuarine scrub/shrub mangroves, are not present in the project area and therefore, are not discussed. Impacts on EFH that are relevant to the proposed dredge material disposal sites are discussed in the EFH assessment (Appendix I).

With the No-Action Alternative, EFH would not be affected.

4.10 Threatened and Endangered Species

Biological assessments of the impacts of the proposed site designation on currently listed threatened and endangered species have been prepared and coordinated with NMFS pursuant to Section 7 of the Endangered Species Act 1973, as amended. The Biological Assessment for the Palm Beach Harbor ODMDS is included as Appendix F and the Biological Assessment for the Port Everglades Harbor ODMDS is included as Appendix G.

Site designation of the Palm Beach Harbor ODMDS and Port Everglades Harbor ODMDS would not adversely affect or threatened the continued existence of any threatened or endangered species.

With the No-Action Alternative, threatened or endangered species would not be affected.

4.11 Hardbottoms

Several distribution surveys for hermatypic and ahermatypic corals have been conducted in the vicinity of the proposed ODMDSs from 1973-1987. No hermatypic corals were found in the vicinity of the project site, but ahermatypic corals were observed as scattered, isolated forms in the vicinity of the proposed ODMDS for Palm Beach Harbor.

The proposed project will not have any effect on wormrock reefs because no known colonies exist within the proposed ODMDS project sites.

Under the No-Action Alternative, hardbottoms would not be affected.

4.12 Fish and Wildlife Resources

Breeding, spawning, and feeding activities may occur near the proposed project areas; however, these activities are not believed to be confined to, or concentrated in, the proposed sites. The probability of significant impact from dredged material disposal to species found within the proposed sites is likely related to the motility of the species.

Both natural and artificial reef sites are found near the proposed ODMDSs. Natural hardbottom reefs occur primarily at depths of 20-100 ft (6-30 m). The seaward extent of the natural reef zone near the Palm Beach Harbor ODMDS is approximately 2.6 nmi (4.8 km) west of the western boundary of the proposed site. The seaward extent of the natural reef zone in the vicinity of the Port Everglades Harbor ODMDS is approximately 3.0 nmi (5.6 km) west of the western boundary of the proposed site. Colonies of the deepwater coral *Oculina varicosa* have been observed as scattered, isolated forms 1.7 nmi (3.2 km) west of the proposed Palm Beach Harbor ODMDS. Artificial reefs occur at a variety of depths, ranging from 10-440 ft (3-134 m). The seaward extent of documented artificial reef structures near the Palm Beach Harbor ODMDS is approximately 2.0 nmi (3.7 km) west of the western boundary of the site. The seaward extent of documented artificial reef structures near the Port Everglades Harbor ODMDS is approximately 2.0 nmi (3.7 km) west of the western boundary of the site. Natural and artificial reefs are not expected to be adversely affected by the proposed project.

4.13 Physical Oceanography

No significant impacts to tides or currents in the project areas are expected to occur.

4.14 Water Quality

The disposal of dredged material is not expected to significantly degrade water quality within disposal sites. The disposal will locally and temporarily increase water column turbidity and concentrations of dissolved and particulate constituents. Dissolved oxygen concentrations may decrease in the dump plume. Plumes of suspended sediments would result in increases in turbidity levels, suspended particulate concentrations, and decreased light transmittance. These effects are also localized, short-term effects dissipated by natural dispersion, mixing, and eventual sinking of particles. Based on dispersion modeling conducted for the Palm Beach/Port Everglades Harbor ODMDSs, any temporary perturbations in water quality resulting from disposal of dredged material would be reduced to ambient or undetectable levels within a short distance of the release point (see Section 4.3.3).

Only dredged material evaluated and found acceptable in accordance with the joint EPA/USACE guidance (EPA/USACE, 1991 and EPA/USACE, 1993) can be disposed in the ocean. The testing evaluates the potential for unacceptable effects such as toxicity or bioaccumulation. These required tests reduce the possibilities of unacceptable water column and benthic effects caused by dredged material contaminants. Palm Beach Harbor and Port Everglades Harbor sediment characteristics reveal that the dredged material is acceptable for ocean disposal.

The No-Action Alternative is expected to have no impact on water quality of both ocean disposal sites.

4.15 Air Quality

The short-term impacts from increased barge or scow traffic associated with the project would not significantly impact air quality of the project sites. No air quality permits would be required for this project. Both Broward and Palm Beach counties are designated as attainment areas for Federal air quality standards under the Clean Air Act. The offshore candidate sites for both Palm Beach Harbor and Port Everglades Harbor would result in higher overall air emissions than the preferred sites. Shown below are typical per load barge tug emissions based on emission factors reported by the Port of San Diego (2003) and an average barge speed of 4.3 knotts.

	Emissions (Pounds/Load)			
Site	**CO**	**NOx**	**SOx**	**PM_{10}**
Palm Beach 4.5-mile (preferred) site	5.0	33	4.7	1.9
Palm Beach 9-mile candidate site	10.0	69.1	9.8	4.0
Port Everglades 4-mile (preferred) site	4.5	30.7	4.4	1.8
Port Everglades 7-mile candidate site	7.8	53.7	7.7	3.1

CO=Carbon monoxide; Nox=Nitrogen oxides; Sox=Sulfur oxides; PM10=Inhalable particles

The No-Action Alternative is expected to have no impact on air quality.

4.16 Noise

The noise at any of the alternative ocean disposal sites would increase during disposal of dredged material. The duration of the noise increase would be greater for the offshore candidate sites. Surface noise for a tugboat is expected to be 82 dB at 50 ft (Port of Oakland and the USACE San Francisco District, 1998). Noise from the tugboats hauling barges or from hopper dredges to and from the ocean disposal sites would be too far from shore to have any meaningful noise impact on noise-sensitive land uses.

Subsurface noise would increase during disposal and monitoring activities in the vicinity of the proposed disposal sites. According to the National Research Council (NRC) (2003), vessel traffic is a major contributor to noise in the world's oceans especially at low frequencies between 5 and 500

kHz. Low-frequency ship noise sources include propeller noise, propulsion machinery and major auxiliaries such as diesel generators. Source spectral density levels for the types of vessels visiting the proposed sites would likely range from more than 165 dB re 1 μPa^2/Hz at 1 meter around 25 Hz for larger vessels down to 140 dB re 1 μPa^2/Hz or less for smaller craft. During monitoring activities, the use of sonar systems for bathymetry measurements or sidescan imagery would also result in subsurface noise (NRC, 2003).

This elevated noise level will be temporary and would not be expected to result in any significant adverse impacts to wildlife or aquatic organisms in the areas. Existing data are insufficient to predict accurately any but the grossest acoustic impacts on marine mammals. Marine mammals as a group have functional hearing ranges of 10 Hz to 200 kHz. Behavioral responses to noise range from subtle changes in surfacing and breathing patterns, to cessation of vocalizations, to active avoidance or escape from the region of the highest sound levels. For fish and elasmobranchs (sharks and rays), the functional hearing range is from well below 50 Hz to upward of 500-1,000 Hz. The hearing range for sea turtles has been measured in the 250-750 Hz range, with the most sensitive threshold recorded a the lowest frequency tested, 250 Hz (NRC, 2003).

The No-Action Alternative would have no effect on the noise environment of the area.

4.17 Aesthetic Resources

No significant impacts on aesthetic resources would result from the proposed actions.

4.18 Recreation

The coastal waters of Broward and Palm Beach counties are used for a variety of recreational activities including swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving. Few of these activities occur in, and none is restricted to, the proposed ODMDSs. No significant impacts to recreation are anticipated.

4.19 Public Safety

There should be no adverse impacts on public safety from the proposed actions.

4.20 Energy Requirements and Conservation

The energy requirements for this activity would be confined to fuel for the construction and transportation equipment. With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Fuel consumption was discussed in Section 4.7.

4.21 Natural or Depletable Resources

In this case, the depletable resources would be the fuel for the construction and transportation equipment and human energy required for the project. The No-Action Alternative would eliminate these requirements, but would allow a continuation of and possible increase in navigational safety and economic problems.

With all being equal concerning construction, equipment and personnel, fuel consumption would only differ with distance and time to each candidate site. This would hold true for comparing dredging operations that included either beach nourishment or ocean disposal. Fuel consumption was discussed in Section 4.7.

4.22 Scientific Resources

No scientific resources would be affected by the proposed actions.

4.23 Native Americans

Native Americans would not be adversely impacted by project activities.

4.24 Reuse and Conservation Potential

No adverse impacts are expected from the proposed project activities. The project does not lend itself to recycling or use of recycled or recyclable materials.

4.25 Urban Quality

No adverse impacts are expected. The project would benefit the local shipping industry and the economy.

4.26 Solid Waste

No solid waste is expected to be generated by project activities. Each site meets all evaluation criteria for use as an ODMDS.

4.27 Drinking Water

Drinking water would not be impacted by the project.

4.28 Indirect Effects

The proposed action may facilitate area dredging projects by providing a disposal option and thereby increase the associated environmental impacts of dredging (water quality degradation, wetland losses, pollution from increased shipping, etc.). The proposed action would benefit the shipping industry and economy. Furthermore, the indirect effect on the Federal standard could make beneficial use projects cost prohibitive by creating a lower cost option.

4.29 Compatibility with Federal, State, and Local Objectives

The proposed action is expected to be consistent with Federal, State and local plans and objectives.

4.30 Conflicts and Controversy

The areas of controversy are the proximity of the ODMDSs to nearshore reefs and the potential impacts of fine-grained material to these reefs. Other issues include: the scope, frequency, and costs of monitoring effects of disposal at the ODMDSs.

4.31 Uncertain, Unique or Unknown Risks

No such risks are known or anticipated at this time. However, in the unlikely event of unacceptable impacts, corrective measures would be taken as required by permit, law, or otherwise as determined to be appropriate.

4.32 Precedent and Principle for Future Actions

The proposed actions would create two new ODMDSs in the Atlantic Ocean to be used initially for the disposal of maintenance dredged material from the existing Palm Beach Harbor and Port Everglades Harbor Federal Navigation Projects, respectively.

4.33 Environmental Commitments

The USACE and contractors commit to avoiding, minimizing or mitigating for adverse effects during disposal activities by including appropriate measures in the contract specifications. Contract specifications implementing the requirements of the SMMPs are provided as an attachment to the SMMPs in Appendix L. For non-Federal users, an attachment to the SMMPs provides standard permit conditions for the sites. In addition, EPA and the USACE commit to environmental monitoring of the proposed ODMDSs dependent upon available funding (see Appendix L).

4.34 Compliance with Environmental Regulations

4.34.1 National Environmental Policy Act of 1969

Environmental information on this federal project has been compiled and the present Environmental Impact Statement is being prepared. The project complies with the National Environmental Policy Act.

4.34.2 Endangered Species Act of 1973

In 1986, NMFS concurred with the original BAs presented by the USACE regarding the impacts of the proposed project to populations of threatened and/or endangered species. Due to the length of time that has passed since this concurrence, however, updated BAs for the proposed sites for Palm Beach and Port Everglades harbors were submitted to NMFS (see appendices F and G). In a letter received 24 May 2004, NMFS indicated that adverse impacts were unlikely to occur to the shortnose sturgeon, smalltooth sawfish, or any of the whale and turtle species listed above as a result of project activities (see Appendix B).

4.34.3 Fish and Wildlife Coordination Act of 1958

No coordination has been attempted with the USFWS. Because only marine waters would be affected, no species under the jurisdiction of the USFWS would be affected.

4.34.4 Clean Water Act of 1972

The project would comply with this Act. A Section 404(b) evaluation is not applicable to this project and was not prepared.

4.34.5 Clean Air Act of 1972

The short-term impacts from transportation and construction equipment associated with the project would not significantly impact air quality. No air quality permits would be required for this project. Because both Broward and Palm Beach counties are designated as attainment areas for Federal air quality standards under the Clean Air Act, a conformity determination is not required.

4.34.6 Coastal Zone Management Act of 1972

A Federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix N.

4.34.7 Farmland Protection Policy Act of 1981

No prime or unique farmland would be impacted by this project. This act is not applicable.

4.34.8 Wild and Scenic River Act of 1968

No designated Wild and Scenic river reaches would be affected by project related activities. This act is not applicable.

4.34.9 Marine Mammal Protection Act of 1972

Incorporation of the safe guards used to protect threatened and endangered species during project activities would protect any marine mammals in the area, therefore, this project is in compliance with the Act.

4.34.10 Estuary Protection Act of 1968

No designated estuary would be affected by project activities. This act is not applicable.

4.34.11 Fishery Conservation and Management Act of 1976

The project has been coordinated with NMFS and is in compliance with the Act.

4.34.12 Submerged Lands Act of 1953

The project would not occur on submerged lands of the State of Florida. This project is in full compliance with this Act.

4.34.13 Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990

No coordination has been made with the USFWS.

4.34.14 Rivers and Harbors Act of 1899

The proposed work would not obstruct navigable waters of the United States. The proposed action has been subject to evaluations normally conducted for activities subject to the Act. The project is in full compliance.

4.34.15 Anadromous Fish Conservation Act

Anadromous fish species would not be affected. The project has been coordinated with NMFS.

4.34.16 Migratory Bird Treaty Act and Migratory Bird Conservation Act

No migratory birds would be affected by project activities. The project is in compliance with these acts.

4.34.17 Marine Protection, Research and Sanctuaries Act

The MPRSA regulates the transportation and subsequent dumping of materials, including dredged material, into ocean waters. Section 102 of the MPRSA requires EPA to designate ODMDSs where needed. The proposed ODMDSs are being designated pursuant to Section 102 of the MPRSA. The five general (40 CFR 228.5) and 11 specific (40 CFR 228.6) criteria for the selection of sites have been applied and satisfied (see sections 4.3.3 and 4.3.4).

4.34.18 Magnuson-Stevens Fishery Conservation and Management Act

The project activities would not have an adverse effect on the fish off the coasts of the United States, the highly migratory species of the high seas, the species which dwell on or in the continental shelf appertaining to the United States, and the anadromous species which spawn in United States rivers or estuaries or their habitats.

4.34.19 E.O.11990, Protection of Wetlands

No wetlands would be affected by project activities. This project is in compliance with the goals of this Executive Order.

4.34.20 E.O. 11988, Flood Plain Management

This project does not occur in any floodplain, therefore, this Executive Order does not apply to project activities.

4.34.21 E.O. 12898, Environmental Justice

The proposed activity would not exclude persons from participating in, deny persons the benefits of, or subject persons to discrimination because of their race, color, or natural origin, nor would the proposed action adversely impact “subsistence consumption of fish and wildlife.” The proposed project complies with this Executive Order.

4.34.22 E. O. 13089, Coral Reef Protection

Executive Order 13089 (E.O. 13089) on Coral Reef Protection, signed by the President on June 11, 1998, recognizes the significant ecological, social, and economic values provided by the Nation's coral reefs and the critical need to ensure that Federal agencies are implementing their authorities to protect these valuable ecosystems. E.O. 13089 directs Federal agencies, including EPA and the USACE whose actions may affect U.S. coral reef ecosystems, to take the following steps:

1. Identify their actions that may affect U.S. coral reef ecosystems;
2. Utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and
3. To the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

It is the policy of EPA and the USACE to apply their authorities under the MPRSA to avoid adverse impacts on coral reefs. Protection of coral reefs have been carefully addressed through the application the site designation criteria which require consideration of the potential site's location in relation to breeding, spawning, nursery, feeding, and passage areas of living marine resources and amenity areas (40 C.F.R. 228.6[a][2] and [3]), interference with recreation and areas of special scientific importance (40 C.F. R. 228.6[a][8]), and existence of any significant natural or cultural features at or in close proximity to the site (40 C.F.R. 228.6[a][11]) (see Section 4.3.4). Based on application of these criteria, the proposed disposal sites should not have adverse affects on coral reefs.

5.0 PUBLIC INVOLVEMENT

5.1 Introduction

EPA, the USACE, and the local sponsors involved the public through outreach programs. A proactive approach was taken to inform the public, resource agencies, industry, local government, and other interested parties about the project and to identify any concerns.

5.2 Notice of Intent

A Notice of Intent for the designation of ODMDSs offshore Palm Beach and Port Everglades harbors was published by the EPA Region 4 Office on June 27, 1997 in the Federal Register (Volume 62, Number 124). Mr. Christopher McArthur is listed as the Point of Contact. A copy of the Notice of Intent is included in Appendix A.

5.3 Scoping Letter

A scoping letter dated April 17, 1995, regarding designation of the Port Everglades Harbor ODMDS, was sent to Federal, State, and local governmental offices and agencies and other concerned entities. A second scoping letter dated September 26, 1997, regarding designation of the Palm Beach Harbor ODMDS, was sent to Federal, State, and local governmental offices and agencies, and other concerned entities. Fourteen letters were received in response to these letters from surrounding businesses and state agencies. A copy of the original scoping letters and response letters are appended to this document (see Appendix A).

5.4 Distribution of Draft and Final FEIS

This draft EIS is being distributed to the following agencies, groups, and individuals for review and comment.

Advisory Council on Historic Preservation
Council on Environmental Quality
Economic Development Commission
Environmental Government Affairs
Federal Maritime Commission
General Services Administration
National Science Foundation
U.S. Department of Commerce
- National Oceanic and Atmospheric Administration
- Atlantic Oceanographic and Meteorological Laboratory
- National Marine Fisheries Service, St. Petersburg Office
- National Marine Fisheries Service, Miami Office
- National Ocean Survey
- Office of Ocean and Coastal Resource Management
- U.S. Coral Reef Task Force

U.S. Department of Defense
- Pentagon
- Department of the Air Force
- Department of the Army Corps of Engineers
- Department of the Navy
- Naval Surface Warfare Center, South Florida Testing Facility

U.S. Department of Energy
U.S. Department of Housing and Urban Development
U.S. Department of Interior
- Fish and Wildlife Service
- Geological Survey
- Minerals and Management Service
- National Park Service (Southeast Regional Office, Archaeology)

U.S. Department of Transportation
- Coast Guard Seventh District, Miami, Florida
- Maritime Administration

U.S. House of Representatives
- Appropriate to areas of Palm Beach Harbor and Port Everglades Harbor

U.S. Senate
- Honorable Bob Graham
- Honorable Bill Nelson

State

Florida Department of Agriculture
Florida Department of Community Affairs
Florida Department of Environmental Protection
Florida Department of Transportation
Florida Division of Historical Resources

Florida Game and Fresh Water Fish Commission
Florida House of Representatives
Appropriate to areas of Palm Beach Harbor and Port Everglades Harbor
Florida Marine Fisheries Commission
Florida OTED
Florida Senate
Appropriate to areas of Palm Beach Harbor and Port Everglades Harbor
Office of the Governor-Florida
Governor of Florida Honorable John Ellis Bush
State of Florida A-95 Clearing House

Local

Palm Beach County
Chairman of County Commissioners
Mayor of the City of Palm Beach
Palm Beach Port Authority

Broward County
Chairman of County Commissioners
Mayor of the City of Fort Lauderdale
Port Everglades Port Authority

Organizations and Public

Atlantic States Marine Fisheries Commission
Coast Alliance
Ocean Conservancy-Southeast Atlantic and Gulf of Mexico Office
Coastal Fuels Marketing, Inc.
Crowley American Transport, Inc.
Cry of the Water (Attn: Dan Clark)
Eller & Company, Inc.
Florida Atlantic University
Florida Audubon Society
Florida Institute of Technology
Florida League of anglers
Florida Sport Fishing Association
Florida Wildlife Federation
Mr. George R. Frost, P.E.
Harbor Branch Oceanographic Institute
International Women's Fishing Association
MAR, Inc.
Michael Swerdlow Companies, Inc.
National Wildlife Federation
National Resources Defense Council
Nova University
Organized Fisherman of Florida
Port Everglades Association, Inc.
Port Everglades Pilots' Association

Rinker Materials Corporation
Rosenstiel School of Marine and Atmospheric Science – University of Miami
(Attn: Tom Lee)
Sierra Club
South Atlantic Fishery Management Council
South Florida Regional Planning Council
S.N. Ship Management, Inc.
Treasure Coast Regional Planning Council
Mr. Gerald M. Ward, P.E.

5.5 Points of Contact

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Cade E. Carter, Jr., P.E.	Civil/Environmental Engineering	GEC	B.S. Civil Engineering, Louisiana State University (LSU)	Project Supervisor, FEIS Review/ Coordination
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Name	Discipline	Affiliation	Education	Role
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Leslie Burges	Document Editing	Golder Associates, Inc.		Document Production (1997 DEIS)

7.0 ADDITIONAL REFERENCES

Avent, R.M., M.E. King, and R.H. Gore. 1977. Topographic and Faunal Studies of Shelf-Edge Prominences off the Central Eastern Florida Coast. *Internationale Revue Der Gesamten Hydrobiologie,* 62(2):185-208.

Blair, S.M., and B.S. Flynn. 1989. "Biological Monitoring of Hard Bottom Reef Communities off Dade County, Florida: Community Descriptions." *Diving for Science* 9-24.

Bolt, R.A. and van den Berg, GP, 2003. “Natural ambient background sound near the waddensea.” Science Shop for Physics, University of Graningen, the Netherlands. October 31, 2003.

Brodehl, Brian, 2003. November 14 email from Brian Brodehl, USACE JacksonvilleDistrict to Christopher McArthur, USEPA Region 4.

Brodehl, Brian, 2004. July 6 phone call between Chris McArthur (USEPA Region 4) and Brian Brodehl (USACE Jacksonville District).

Brooks, D.A., 1975. *Wind-Forced Continental Shelf Waves in the Florida Current.* Ph.D. dissertation, Uinversity of Miami, Florida.

Broward County, 2003. Broward County Artificial Reef Locations. Internet publication: http://www.broward.org/bri00502.htm. Prepared by Biological Resources Division.

Burks, S.L., and R.M. Engler. 1978. *Water Quality Impacts of Dredged Material Disposal: Laboratory Investigations.* Technical Report DS-78-04, Waterways Experiment Station, Vicksburg, Mississippi.

CH2M Hill, Inc., 1985. *Application for Discharge Modification for the Virginia Key Sewage Treatment Outfall; General Information and Basic Data Requirements.* CH2M Hill Southeast, Deerfield Beach, Florida.

Clarke, T. H., and Stearn, C. W., 1968. Geologic Evolution of North America (Second Edition). The Ronald Press Company, New York, 570 pp.

Coastal Engineering Research Center, “Evaluation of the Miami Ocean Dredged Material Disposal Site (ODMDS)” CEWES-CR-P. March 21, 1995.

Coastal Engineering Research Center, “Evaluation of the Dispersion Characteristics of the Miami and Fort Pierce Dredged Material Disposal Sites.” 1989.

Conservation Consultants, Inc., 1985. Environmental Survey in the Vicinity of an Ocean Dredged Material Disposal Site, Miami Harbor, Florida. Palmetto, Florida, 55 pp.

Continental Shelf Associates, Inc. 1984. *Environmental Assessment of the Palm Beach County Erosion Control Program: Phase I: Ocean Ridge*. Final report for the Palm Beach County Board of County Commissioners. 110pp.

Continental Shelf Associates, Inc. 1985. *Environmental Assessment of the Palm Beach County Erosion Control Program: Phase II: North Boca Raton.* Final report for the Palm Beach County Board of County Commissioners. 114pp.

Continental Shelf Associates, Inc. 1987. *Environmental Assessment of the Palm Beach County Erosion Control Program: Phase III: Jupiter/Tequesta*. Final report for the Palm Beach County Board of County Commissioners. 50pp.

Continental Shelf Associates, Inc. 1989. *Final Report for a Field Survey of an Ocean Dredged Material Disposal Site Off Palm Beach Harbor, Florida.* Prepared for Department of the Army Corps of Engineers, Jacksonville District, Florida.

Continental Shelf Associates, Inc. 1993. *Coast of Florida Erosion and Storm Effects Study, Region III: Mapping and Classification of Hard Bottom Areas in Coastal Waters off Palm Beach, Broward, and Dade Counties.* Final report for the U.S. Army Corps of Engineers, Jacksonville District, Jacksonville, Florida. Three individual county reports, 30 pp. each.

Courtenay Jr., W.R., D.J. Herrema, M.J. Thompson, W.P. Azzinaro, and J. Van Montfrans. 1974. *Ecological Monitoring of Beach Erosion Control Projects, Broward County, Florida, and Adjacent Areas*. TM 41, U.S. Army Corps of Engineers, Fort Belvoir, VA, 88pp.

Courtenay Jr., W.R., B.C. Hartig, and G.R. Loisel. February 1980. Ecological Evaluation of a Beach Nourishment Project at Hallandale (Broward County), Florida, Volume I: Evaluation of Fish Populations Adjacent to Borrow Areas of Beach Nourishment Project, Hallandale (Broward County), Florida. MR 80-1, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA, 23 pp.

Darnell, R.M., Defenbaugh, R.E., and Moore, D., 1983. *Atlas of Biological Resources of the Continental Shelf, NW Gulf of Mexico.* BLM Open File Report No. 82-04. Minerals Management Service, New Orleans, Louisiana.

Duane, D.B., and E.P. Meisburger. November 1969. *Geomorphology and Sediments of the Nearshore Continental Shelf Miami to Palm Beach, Florida.* TM-29, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA, 120 pp.

Emery, K.O., Ballard, R.D., and Wigley, R.L., 1970. "A dive aboard *Ben Franklin* off West Palm Beach, Florida." Marine Technology Society Journal, Vol. 4, p.7-13.

Fletcher, A. 2003. e-mail from Al Fletcher, Jacksonville District Corps of Engineers to William Lang, Jacksonville District Corps of Engineers, re: Palm Bch ODMDS. November 21, 2003.

Fornshell, J.A., 2000. "Variability of Florida Current Offshore from Fort Pierce Florida as Revealed by Satellite Imagery." Marine Techology Society Journal, Vol. 34, No. 2.

Fritts, T.H., Irvine, A.B., Jennings, R.D., Collum, L.A., Hoffman, W., and McGhee, M.A., 1983. *Turtles, Birds, and Mammals in the Northern Gulf of Mexico and Nearby Atlantic Waters.* U.S. Fish and Wildlife Service, Publication FWS/OBS-82/64.

Fuller, D.A. 1978. "The habitats, distribution, and incidental capture of sea turtles in the Gulf of Mexico." Appendix A to *Shrimp Fishery Management Plan of the U.S. Gulf of Mexico.* Center for Wetland Resources, Louisiana State University, Baton Rouge, Louisiana.

Futch, C.R., and S.E. Dwinell. 1977. *Nearshore Marine Ecology at Hutchinson Island, Florida: 1971-1974. Vol. IX, Lancelets and Fishes*. Florida Marine Research Publication No. 25. 23 pp.

Goldberg, W.M., 1970. Some Aspects of the Ecology of the Reefs off Palm Beach County, Florida, with Emphasis on the Gorgonacea and their Bathymetric Distribution. M.S. Thesis, Florida Atlantic University. 108 pp.

Goldberg, W.M., 1973. The Ecology of the Coral-Octocoral Communities off the Southeast Florida Coast: Geomorphology, Species Composition, and Zonation. *Bulletin of Marine Science* 23:465-488.

Goldberg, W.M., P.A. McLaughlin, and S. Mehadevan. 1985. *Long Term Effects of Beach Restoration in Broward County, Florida: A Three Year Overview. Part II, Infaunal Community Analysis*. Report submitted to Broward County Environmental Quality Control Board. 31 pp.

Herrema, D.J., 1974. Marine and Brackish Water Fishes of Southern Palm Beach and Northern Broward Counties, Florida. M.S. Thesis, Florida Atlantic University. 257 pp.

Hoffmeister, J.E., K.W. Stockman, and H.G. Multer, 1967. "Miami Limestone of Florida and its Recent Bahamian Counterpart." *Geological Society of America Bulletin* 78:175-190.

Jaap, W. C., 1984. The Ecology of the South Florida Coral Reefs: A community Profile. U.S. Fish and Wildlife Service Report FWS/OBS - 82/08. 138 pp.

Kirtley, D.W., 1974. Geological Significance of the Polychaete Annelid Family Sabellaridae. Ph.D. dissertation, Florida State University. 270 pp.

Lazell, J.D., 1980. "New England waters: critical habitat for marine turtles." *Copeia* 1980, Vol. 2, p. 290-295.

Lee, T. N., 1975. "Florida Current spin-off eddies." Deep-sea Research, Vol. 22. p. 753-763.

Lee, T.N., and Mayer, D.A., 1977. "Low-Frequency Current Variability and Spin-Off Eddies along the Shelf off Southeast Florida." Journal of Marine Research, Vol 35, No. 1, pp. 193-220.

Lee, T.N. and Mooers, C.N.K., 1977. "Near-bottom temperature and current variability over the Miami slope and terrace." Bulletin of Marine Science, Vol. 27, p. 758-775.

Lee, T.N., Brooks, I., and Duing, W., 1977. "The Florida Current: Its Structure and Variability." Technical Report UM-RSMAS No. 77003, University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Miami, Florida.

Lighty, R.G., I.G. MacIntyre, and R. Stuckenrath. 1978. "Submerged Early Holocene Barrier Reef South-east Florida Shelf." *Nature* (London) 276 (5683):59-60.

Lovejoy, D.W. 1987. "The Anastasia Formation in Palm Beach and Martin Counties, Florida." Symposium on South Florida Geology. *Miami Geological Society Memoir* 3:58-72.

Luckhurst, B.E., and K. Luckhurst. 1978. "Analysis of the Influence of Substrate Variables on Coral Reef Fish Communities." *Marine Biology* 49:317-323.

Marsh, G.A., P.R. Bowen, D.R. Deis, D.B. Turbeville, and W.R. Courtenay Jr., March 1980. *Ecological Evaluation of a Beach Nourishment Project at Hallandale (Broward County), Florida, Volume II: Evaluation of Benthic Communities Adjacent to a Restored Beach, Hallandale (Broward County), Florida.* MR 80-1, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA, 32 pp.

Marshall, H. G. 1971. Composition of phytoplankton off the southeastern coast of the United States. *Bulletin of Marine Science* 21:806-825.

Michel, H.B., and J.F. Michel. 1991. Heteropod and Thecosome (Mollusca: Gastroopoda) Macroplankton in the Florida Straits. *Bulletin of Marine Science* 49(1-2):562-574.

Minerals Management Service, 1989. Draft Environmental Impact Statement, Gulf of Mexico Sales 123 and 125: Central and Western Planning Areas. Gulf of Mexico OCS Regional Office, New Orleans, Louisiana.

Modde, T. 1980. "Growth and Residency of Juvenile Fishes within a Surf Zone Habitat in the Gulf of Mexico." *Gulf Research Report* 6:377-385.

Modde, T., and S.T. Ross. 1981. "Seasonality of Fishes Occupying a Surf Zone Habitat in the Northern Gulf of Mexico." *Fisheries Bulletin* 78:911-922.

Murphy, Tim, 2004. July 2nd phone call between Chris McArthur (USEPA Region 4) and Tim Murphy, Jim McAdams, and William Lang (USACE, Jacksonville District).

Murray, G. E., 1961. Geology of the Atlantic and Gulf Coastal Province of North America. Harper and Brothers Publishers, New York, 692 pp.

National Research Council (NRC) of the National Academies, Ocean Studies Board, 2003. "Ocean Noise and Marine Mammals." National Academies Press, Washington D.C. 2003.

National Oceanic and Atmospheric Administration. "Miami Harbor Dredged Material Disposal Project." Prepared by the Atlantic Oceanographic and Meteorological Laboratory. June 1991.

Olsen & Associates, 2003. *Port Everglades Inlet Sand Management, Phase I: Sand Bypassing Feasibility Study.* Prepared for Broward County DPEP & Florida DEP, by Olsen & Associates, Inc. Jacksonville, Florida. December 2003.

Palm Beach County, 2002. Artificial Reef Locations. Internet publication: http://www.pbcgov.com/erm/divisions/enhancement/habitat/artificial_reef/td_&_gps.htm. Prepared by Environmental Enhancement and Restoration.

Parker, R.O. and R.W. Mays, 1998. *Southeastern U.S. Deepwater Reef Fish Assemblages, Habitat Characteristics, Catches, and Life History Summaries*. NOAA Tech. Rpt. NMFS 138. Sept. 1998.

Pequegnat, W.E., Pequegnat, L.H., James, B.M., Kennedy, E.A., Fay, R.R., and Fredericks, A.A., 1981. *Procedural Guide for Designation Surveys of Ocean Dredged Material Disposal Sites.* Final Report by TerEco Corporation. Technical Report EL-81-1, Waterways Experiment Station, Vicksburg, Mississippi.

Peters, D.J., and W.G. Nelson, 1987. "The Seasonality and Spatial Patterns of Juvenile Surf Fishes of the Florida East Coast." *Florida Scientist* 50(2):85-99.

Port of Oakland and the U.S. Army Corps of Engineers San Francisco District, 1998. "Final Environmental Impact Statement/Environmental Impact Report and Final Feasibility Study for the Proposed Oakland Harbor Navigation Improvement Project, Alamenda County, California." May 1998.

Port of San Diego Port District, 2003. Draft Supplemental Environmental Impact Report (EIR) for the Camphell Sediment Remediation/Aquatic Enhancement Project. July 2003.

Provancha, J.A., and Provancha, M.J., 1988. "Long-term trends in abundance and distribution of manatees in the northern Banana River, Brevard County, Florida." Marine Mammal Science Vol. 4, p. 323-338.

Provancha, J.A., and Hall, C.R., 1991. "Observations of associations between seagrass beds and manatees in east central Florida. Florida Scientist, Vo. 54, p. 87-98.

Porter, J. W. 1987. "Reef Building Corals." In: *Species profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (South Florida).* Biological Report 82(11.73) TR EL-82-4.; U. S. Fish and Wildlife Service, National Wetlands Research Center, Slidell, LA.

Raymond, B., and A. Antonius. 1977. *Biological Monitoring Project of the John U. Lloyd Beach Restoration Project*. Final report for Broward County Erosion Prevention District, Broward County, Florida.

Rebel, T. P. 1974. *Sea turtles and the turtle industry of the West Indies, Florida, and the Gulf of Mexico.* Coral Gables, Florida, University of Miami Press, 250 pp.

Reed, J.K. 1980. Distribution and structure of deep-water Oculina varicosa coral reefs off central eastern Florida. *Bulletin of Marine Science* 30(3):667-677.

Saucier, R.T., Calhoun, C.C., Jr. Engler, R.M., Patin, T.R., and Smith, H.K., 1978. "Executive Overview and Detailed Summary, Dredged Material Research Program." Techical Report DS-78-22, Waterways Experiment Station, Vicksburg.

Schmidly, D.J., 1981. *Marine Mammals of the Southeastern United States and the Gulf of Mexico.* U.S. Fish and Wildlife Service Publication FWS/OBS-80/41, 166 pp.

South Florida Ocean Measurement Center, 2002. Facility Chart and SFTF Range. Internet publication: http://www.sfomc.org/overview2.html.

Starch Jr., W.A. 1968. "A List of Fishes of Alligator Reef, Florida with Comments on the Nature of the Florida Reef Fish Fauna." *Undersea Biology* 1:40-40.

Taylor, W.R. 1979. *Marine Algae of the Eastern Tropical and Subtropical Coasts of the Americas.* University of Michigan Press: Ann Arbor, Michigan.

Turbeville, D.B., and G.A. Marsh. January 1982. Benthic Fauna of an Offshore Borrow Area in Broward County, Florida. MR 82-1, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA, 42 pp.

U.S. Army Corps of Engineers, 1998. *Dispersion Characteristics for Palm Beach and Port Everglades Ocean Dredged Material Disposal Sites (ODMDSs).* Waterways Experiment Station, M.A. Cialone and L.S. Lillycrop, compilers. Miscellaneous Paper CHL-98-xx, September 1998.

U.S. Department of the Interior, 1977. Draft Environmental Impact Statement, Vol. 1. *Proposed 1977 Outer Continental Shelf Oil and Gas Lease Sale; South Atlantic OCS Sale No. 43*. Bureau of Land Management.

U.S. Environmental Protection Agency, 1973. "Ocean Outfalls and Other Methods of Treated Wastewater Disposal in Southeast Florida." Final Environmental Impact Statement, Region IV Office, Atlanta, Georgia.

U.S. Environmental Protection Agency. 1992. *Water Quality Protection Program for the Florida Keys National Marine Sanctuary: Phase I Report*. Final report submitted to the Environmental Protection Agency under Work Assignment 3-225, Contract No. 68-C8-0105 by Battelle Ocean Sciences, Duxbury, Massachusetts and Continental Self Associates, Inc., Jupiter, Florida.

U. S. Environmental Protection Agency, 1995. Status of the Palm Beach ODMDS Designation. EPA Region 4, Atlanta, September 26, 1995, 13 pp.

U.S. Environmental Protection Agency, 1998. *Characteristics of Southeast Florida Publicly Owned Treatment Works*. With an excerpt from *Looking Seaward: Development of a State Ocean Policy for Florida* by Donna R. Christie, Florida State University College of Law, July 1997.

U.S. Environmental Protection Agency, June 1999. *Sediment and Water Quality of Candidate Ocean Dredged Material Disposal Sites for Port Everglades and Palm Beach, Florida*. Prepared by Region 4, Wetlands, Coastal and Water Quality Branch.

U.S. Fish and Wildlife Service. 1982. Gulf Coast Ecological Inventory, West Palm Beach, Florida. 26080-A1-EI-250.

Uchupi, E., 1968. Atlantic Continental Shelf and Slope of the United States- Physiography. Geological Survey Professional Paper 529-C. United States Government Printing Office, Washington, D. C., 30 pp.

Van Montfrans, J. 1981. Decapod Crustaceans Associated with Worm Rock (*Phragmatopoma lapidosa* Kinberg) in Southeastern Florida. M.S. Thesis, Florida Atlantic University. 290 pp.

Vare, C.N. August 1991. A Survey, Analysis, and Evaluation of the Nearshore Reefs Situated off Palm Beach County, Florida. Thesis submitted to the College of Social Science, Florida Atlantic University: Boca Raton, Florida.

Wheaton, J.L. 1987. "Observations on the Octocoral Fauna of Southeast Florida's Outer Slope and Fore Reef Zones." *Caribbean Journal of Science* 23(2):306-312.

Windom, H.L., 1976. Environmental aspects of dredging in the coastal zone." CRC Critical Reviews in Environmental Control. VOl. 6, No. 2. CRC Press, Cleveland, Ohio.

Zieman, J.C., 1982. *The Ecology of the Seagrasses of South Florida: A Community Profile.* U.S. Fish and Wildlife Service, Publication FWD/OBI-82/25, 158 pp.

8.0 ABBREVIATIONS

ADCP	Acoustic Doppler Current Profiler
AUV	autonomous undersea vehicle
BA	Biological Assessment
CAA	Clean Air Act
cc	cubic centimeter
CERC	Columbia Environmental Research Center
CFR	Code of Federal Regulations
CSA	Continental Shelf Associates, Inc.
dB	decibel
DEIS	Draft Environmental Impact Statement
DO	dissolved oxygen
DOI	Department of the Interior
EFH	Essential Fish Habitat
EO	Executive Order
EPA	U.S. Environmental Protection Agency
FACDAR	forward area combined degaussing and acoustic range
FDEP	Florida Department of Environmental Protection
FEIS	Final Environmental Impact Statement
FFWCC	Florida Fish and Wildlife Conservation Commission
FMC	Fishery Management Council
FMP	Fishery Management Plan
ft	foot
g	gram
GEC	Gulf Engineers and Consultants, Inc.
HAPC	Habitat Areas of Particular Concern
HURDAT	Hurricane Database
Hz	Hertz

ICWW	Intracoastal Waterway
IDEA	interim depth electromagnetic array
km	kilometer
l	liter
m	meter
m^2	square meter
Ma	million years ago
mg	milligram
mm	millimeter
MMS	Minerals Management Service
MPRSA	Marine Protection, Research, and Sanctuaries Act
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
nmi	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NTU	nephelometric turbidity unit
ODMDS	Ocean Dredged Material Disposal Site
OPA	Office of Public Affairs
OSCAR	Ocean Current Surface Radar
Pa	Pascale
PCB	polychlorinated biphenyl
PCS	Permit Compliance System
PL	Public Law
ppb	parts per pillion
PPB	PPB Environmental Labs, LLC
RIM	Regional Implemental Manual
SAFMC	South Atlantic Fishery Management Council
SFOMC	South Florida Ocean Management Center
SFTF	South Florida Testing Facility
SMMP	Site Management and Monitoring Plans
sp.	species
STFATE	short-term fate

SWAR	shallow water acoustic range
SWER	shallow water electromagnetic range
TPH	total petroleum hydrocarbon
USACE	U.S. Army Corps of Engineers
USC	U.S. Congress
USFWS	U.S. Fish and Wildlife Service
WES	Waterways Experiment Station
WRDA	Water Resource Development Act
µg	microgram

9.0 GLOSSARY

Adverse Impact - A detrimental effect relative to desired or baseline conditions.

Affected Environment - Existing biological, physical, social and economic conditions of an area subject to change, both directly and indirectly, as a result of a proposed human action.

Air Quality - A measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of contaminating or injurious substances.

Aquatic - Consisting of, relating to or being in water; living or growing in, on or near the water; or taking place in or on the water.

Authorization - An act by the U.S. Congress that authorizes use of public funds to carry out a prescribed action.

Bathymetry - A detailed, precise description of an underwater place or region; or the graphic representation of the surface features of an underwater place or region on a map, indicating its relative position and elevations.

Benthic - The bottom of rivers, lakes or oceans, and the organisms that live on the bottom of water bodies.

Biodiversity - The number and variety of organisms found within a specified geographic region; or the variability among living organisms on the earth, including the variability within and between species and within and between ecosystems.

Biological Assessment (BA) - A biological evaluation conducted for major Federal construction projects requiring an Environmental Impact Statement. BAs are developed to assess probable impacts of USFWS projects to Federally listed species.

Carbonate - sedimentary rock composed primarily of calcium carbonate, usually formed by chemical precipitation

Critical Habitat - A description, which may be contained in a Biological Assessment, of the specific areas with physical or biological features essential to the conservation of a listed species and which may require special management considerations or protection; these areas have been legally designated via Federal Register notices.

Cumulative impacts - Impacts on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions.

Density - The mass per unit volume of a substance under specified conditions of pressure and temperature.

Discharge - The rate of water movement as volume per unit time, usually expressed as cubic feet per second.

Dissolved Oxygen (DO) - The concentration of oxygen dissolved in water, sometimes expressed as percent saturation, where saturation is the maximum amount of oxygen that theoretically can be dissolved in water at a given altitude and temperature.

Dredged material- Material excavated from waters of the United States or ocean waters.

Ecology - The science of the relationships between organisms and their environments, also called bionomics; or the relationship between organisms and their environment.

Ecosystem - An ecological community together with its environment, functioning as a unit.

Endangered Species - Any species or subspecies of amphibian, bird, fish, mammal, reptile or plant that is in serious danger of becoming extinct throughout all or a significant portion of its range.

Environmental Impact Statement - A detailed written statement that documents the proposed action, alternatives to the proposed action, the characteristics of the environment that is potentially affected by the proposed action, and the environmental consequences of implementing each alternative.

Feasibility Study - The phase of a project whose purpose is to describe and evaluate alternative plans and fully describe a recommended project.

Federally Endangered Species - An Endangered Species which is officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service and published in the Federal Register.

Habitat - The area or environment where an organism or ecological community normally lives or occurs.

Hardgrounds - synsedimentarily lithified carbonate seafloors.

Infauna - Animals that live within the sediment of the ocean bottom.

Invertebrate - An animal that does not have a backbone; examples include crayfish, insects and mollusks.

Juvenile - A young organism older than one year but not having reached reproductive age.

Larva - an embryo that differs markedly in appearance from adult members of its species and becomes self-sustaining before assuming the physical characteristics of its adult form.

Latitude - The angular distance north or south of the earth's equator, measured in degrees along a meridian.

Limnology - The scientific study of the physical characteristics and biology of lakes, streams and ponds.

Local sponsor - The entity that is partnering with the Federal Government to complete a specific project or program.

Longitude - The angular distance on the earth's surface, measured east or west from the prime meridian at Greenwich, England, to the meridian passing through a position, expressed in degrees (or hours), minutes and seconds.

Mitigation - To make less severe; to alleviate, diminish or lessen.

Model - A way of looking at reality, usually for the purpose of abstracting and simplifying it to make it understandable in a particular context; this may be a plan to describe how a project will be completed, or a tool to mathematically represent a process which could be based upon empirical or mathematical functions.

Monitoring - The capture, analysis and reporting of project performance, usually as compared to plan.

Nutrients - Elements essential as raw materials for the growth of an organism.

Objective - A goal expressed in specific, directly measurable terms.

Ocean disposal - placement of dredged material in oceans via pipeline or surface release from hopper dredgers or barges.

Ocean Dredged Material Disposal Site (ODMDS) - a site in the ocean designated by EPA for the reception of dredged material.

PCB - Polychlorinated biphenyls, a group of organic compounds used in the manufacture of plastics. PCBs are highly toxic to aquatic life, are biologically accumulative, and persist in the environment for long periods of time.

Project - A sequence of tasks with a beginning and an end that uses time and resources to produce specific results.

Project area - An area subject to change, both directly and indirectly, as a result of a proposed human action, or project.

Public Involvement - The process of obtaining citizen input into each stage of the development of planning documents, and which is required as a major input into any environmental impact statement.

Quality Assurance - The process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

Record of Decision - A concise, public legal document which identifies publicly and officially discloses the responsible official's decision on the alternative selected for implementation; prepared following completion of an Environmental Impact Statement.

Reef - A resistant ridge of calcium carbonate formed on the seafloor by corals and coralline algae.

Scope - The sum of the products and services, in fact the magnitude of the effort, required to complete a project.

Scoping - The process of defining the extent and content of a study, primarily with respect to the issues, geographic area and alternatives to be considered.

Sediment - The layer of soil, sand, and/or rock fragments at the bottom of waterbodies.

Threatened Species - Legal status afforded to plant or animal species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range, as determined by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

Tide - The periodic variation in the surface level of the oceans and of bays, gulfs, inlets and estuaries caused by gravitational attraction of the moon and sun.

Turbidity - An optical measure of the amount of material suspended in the water column. Increases in turbidity decrease the amount of light that penetrates the water column.

Water Quality - A measure of the health-related and visual characteristics of the water, often derived from quantitative measurements of the concentrations of contaminating or injurious substances.

Water Resources Development Act (WRDA) - Legislation that provides for the conservation and development of water and related resources and authorizes the Secretary of the Army to construct various projects for improvements to rivers and harbors of the United States, and for other purposes deemed appropriate by the U.S. Congress and the President of the United States.

10.0 CONVERSION FACTORS

Unit	Conversion Unit	Conversion Factor
acres	ft^2	43560
acres	m^2	4046.9
atmospheres (atm)	feet of water	33.94
atmospheres	in of Hg	29.92
atmospheres	mm of Hg	760
atmospheres	psi	14.7
bar	atm	.98692
bar	dyne cm^{-2}	10^6
bar	psi (lb in^{-2})	14.5038
bar	mm Hg	750.06
bar	MPa	10^{-1}
barrel (bbl)	ft^3	5.6146
barrel	m^3	.15898
barrel	gal (US)	42
barrel	liter	158.9
centimeter (cm)	inch	0.39370
cm	m	10^{-2}
fathom (fath)	ft	6
feet (ft)	in	12
feet	m	0.3048
furlong	yd	220
gallon (US) (gal)	in^3	231
gallon	liter	3.78541
gallon (Imp.) (gal)	in^3	277.419
gallon	liter	4.54608
gram (g)	pound	0.0022046
gram	kg	10^{-3}
hectare	acre	2.47105
hectare	cm^2	10^8
inch (in)	cm	2.54
inch (in)	mm	25.4
kilogram (kg)	g	10^3
kilogram	pound	2.20462
kilometer (km)	m	10^3
kilometer	ft	3280.84

Unit	Conversion Unit	Conversion Factor
kilometer	mile	0.621371
knot	mph	1.150779
liter	cm^3	10^3
liter	gal (US)	0.26417
liter	in^3	61.0237
meter	angstrom	1×10^{10}
meter	ft	3.28084
micron	cm	10^{-4}
mile	ft	5280
mile	km	1.60934
mile	nautical mile	0.8689741
nautical mile	mile	1.150782
ounce	lb	0.0625
Pascal	atmospheres	$9.86923 * 10^{-6}$
Pascal	psi	$1.45 * 10^{-4}$
Pascal	torr	$7.501 * 10^{-3}$
pint	gallon	0.125
pound (lbm)	kg	0.453592
pound (lbf)	newton	4.4475
quart	gallon	0.25
ton (long)	lb	2240
ton (Metric)	lb	2205
ton (Metric)	kg	1000
ton (short or net)	lb	2000
ton (short or net)	kg	907.185
ton (short or net)	ton (Metric)	.907
yard	in	36
yard	m	0.9144
year (cal)	days	365.242198781
year (cal)	s	3.15576×10^7